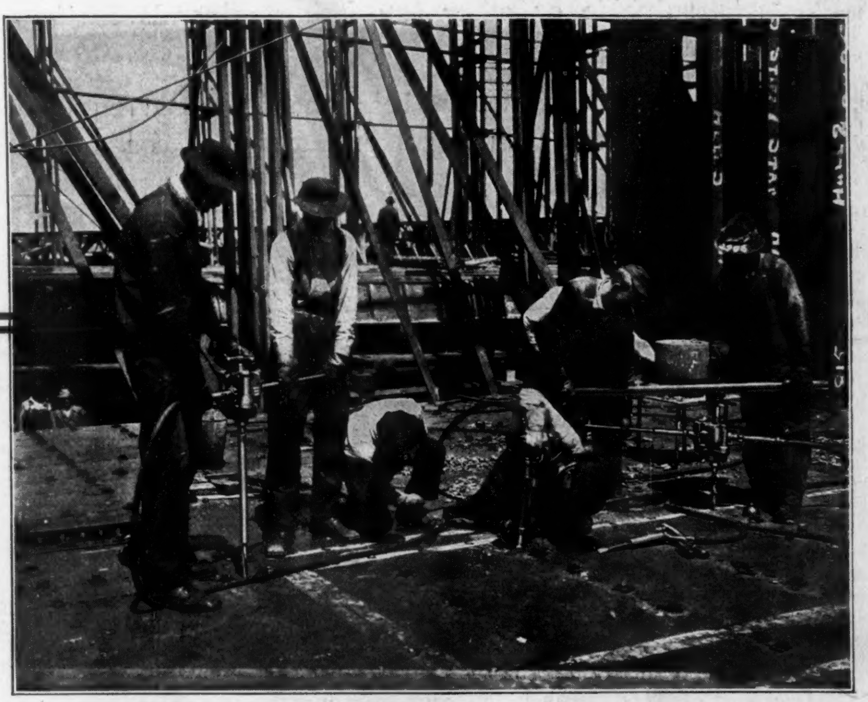
Engineering Library
NOV 15 1917
UNIV. OF MICH. LIBRARY

COMPRESSED AIR MAGAZINE

DEVOTED TO THE USEFUL APPLICATIONS OF COMPRESSED AIR

Vol. xxii NOVEMBER, 1917 No. 11



"Little David" Pneumatic Tools

Have definately proved that their use is marked by a saving in air consumed and a decrease in the cost of tool maintenance.

SEE THE COMPLETE "LITTLE DAVID" CATALOG.

NEW YORK INGERSOLL--RAND COMPANY LONDON

OVER 15,000 COPIES THIS ISSUE

Published by THE COMPRESSED AIR MAGAZINE CO., Easton, Pa.

NEW YORK, Bowling Green Building LONDON, 165 Queen Victoria Street

Classified Buyers' Guide, Page 14. Index to Advertisers, Page 11.

The STEARNS-ROGER Mfg. Co.

can assist you in securing a substantial bonus payable for the highest grade

Manganese-Tungsten and Chromite

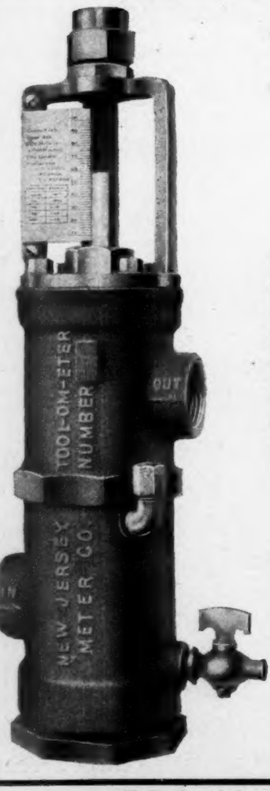
concentrates. These are almost invariably slightly magnetic and by means of

The Wetherill Magnetic Separator

garnets, sulphide or other interfering minerals can be readily eliminated.

More Wetherill machines are being manufactured for this purpose at present than in all previous years combined.

Write The **STEARNS-ROGER MFG. CO., DENVER COLO.,** for catalogue



THE TOOL-OM-ETER

The wind bloweth where it listeth
And what do you care?
But COMPRESSED AIR costs money
And the AIR goes WHERE?

This little meter gives you the answer. Shows ***at a glance*** how much air is used by your sluggers, guns, jacks, japs, giants, rammers, riveters, motors, etc.—when they are new, after a month, three months, before and after overhauling and putting in new parts. Enables you to locate and remove leaks, losses and "air eaters" and to keep your equipment in effective and economical working condition. You can stop losses, decrease costs and increase your output with the same compressor capacity.

"The day of guesswork is past."

Write for further information stating what uses you make of Compressed Air.

ASK FOR BULLETIN 5-A.

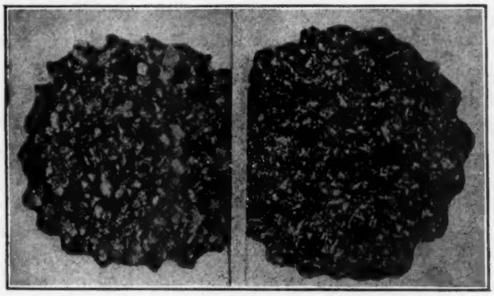
NEW JERSEY METER CO.

PLAINFIELD, NEW JERSEY

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Vol. xxii. NOVEMBER, 1917 No. 11.



NEW SAND USED SAND

SAND BLAST PRACTICE

BY DAVID EVANS*

As everyone connected with the foundry industry knows, sand blasting is a method of applying sand under air pressure to rough castings to remove the dirt and scale as they come from the foundry.

Sand-blasting should be, and usually is, the first work done on a rough casting preparatory to chipping and grinding. The sand-blast operation, therefore, should be done at a point on the line of route between the molding floor and the cleaning room.

THE SAND MUST BE DRY

Some of the earlier attempts to use sand as a cleaning agent called for the employment of live steam in place of air. This method was said to be effective for cleaning certain kinds of castings for plating, but it made a very dirty and disagreeable job and was abandoned after a short time. This attempt to use live steam is interesting because in modern practice nothing causes so much trouble in the operation of the sand-blast as moisture. Regardless of the method or the type of machine used, or the grade of sand, care must be taken that the sand is "bone-dry" when it is charged into the machine and that no moisture created by the condensation of the air in the pipe line be permitted to come into contact with the sand, as it will choke up the machine, or at best will cause a pulsating effect instead of a steady, even flow.

AIR PRESSURE

For cleaning non-ferrous metals and for malleable and cast iron, a lower air pressure and a finer grade of sand may be used than for steeel. Steel castings are difficult to clean. The metal is poured at a high temperature, and the molding sand burns in so that the only effective method of cleaning is by a sand-blast using air at a pressure of about 80 lb. High pressure, although costing more to produce, is invariably recommended for steel castings and, reckoned by the saving in time and the increase in work accomplished, is really cheaper in the long run. It has been estimated by some engineers that it costs about 15 per cent. more to deliver air to the machine at 80 lb. than at 35 to 40 lb., but that the air at 80-lb. pressure strikes a 44 per cent harder blow, resulting in saving of time, and consequently an increase of work of about the same per cent, leaving a net saving in favor of the higher pressure machine of 25 per cent. There is a further benefit in using higher pressure in that it requires a smaller volume of sand, and consequently creates a smaller volume of dust, which must be handled and eliminated, so that the saving in the use of the sand itself and the less amount of dust to be handled are both proper credits in favor of the high pressure.

FOUR FAMILIAR TYPES OF EQUIPMENT

There are several different methods of sand-

---

*President and Treasurer Chicago Steel Foundry Company. Article reprinted from *Iron Age*, Sept. 20, 1917, with some curtailment.

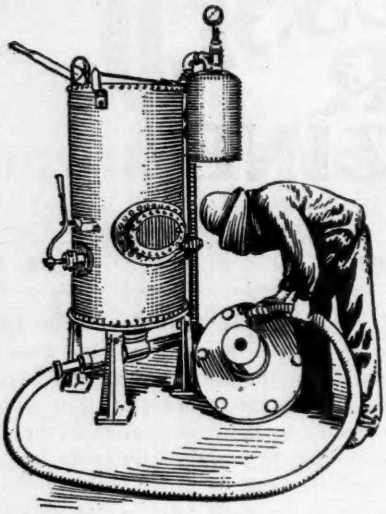


FIG. I. USE OF HOSE

blasting, and a different type of equipment for each method as follows:

Sand-blast hose machine
Sand-blast table
Sand-blast tumbling mill
Sand-blast room

In considering the installation of a system for any particular plant, special attention must be given to the quantity and character of the work turned out in order to select the equipment best adapted. A steel foundry turning out as small a quantity as 3 tons per day needs a sand-blast just as much as a plant turning out ten times that amount, and for small plants where the volume of work does not justify a heavy outlay for equipment, the sand-blast hose machine is very satisfactory. This type of machine, Figs. 1 and 2 is common, and most foundrymen are so familiar with it that a detailed description is hardly necessary. Because of its flexibility, i. e., the capability of being used on any class of work, it is still a favorite in its modern form where the work is of a miscellaneous character.

THE NOZZLE

The part which receives the greatest wear and which requires the most frequent replacement is the nozzle. Our first experience in sand-blasting was with a machine of this type, and we were able to effect a great saving in the cost of nozzles by designing a single piece to take the place of the three-piece nozzle furnished by the manufacturer. This single-piece nozzle is cast of hard manganese steel with flat threads on the neck to fit the inside surface of the hose. The hole is tapered, the end within the hose being but a thin shell to offer as little resistance as possible to the sand. About twenty are cast on one gate, and they are broken off by the workman as he needs them. The action of the sand very soon increases the diameter of the hole to such an extent that it will consume twice the amount of air that it is intended to use. These nozzles require changing once or twice a day, and the changes are made by the operator within a very short time. This is a very important point, as the plant may provide 100 cu. ft. of air per minute for a small sand-blast hose machine and find that it uses 200 cu. ft. because of a worn-out nozzle.

THE ROTATING TABLE

The sand-blast table, Fig. 4, consists of a circular, grated disk in a horizontal position. Compressed air, preferably at 80 lb. or more pressure, carries the abrasive and discharges it through one or more nozzles upon the work resting on the disk. When one side of the work is cleaned, the casting is turned over so that it can be blasted on the opposite side. The nozzles are placed to discharge the abrasive at an angle from the vertical so that the sides and top of the casting are cleaned at the same

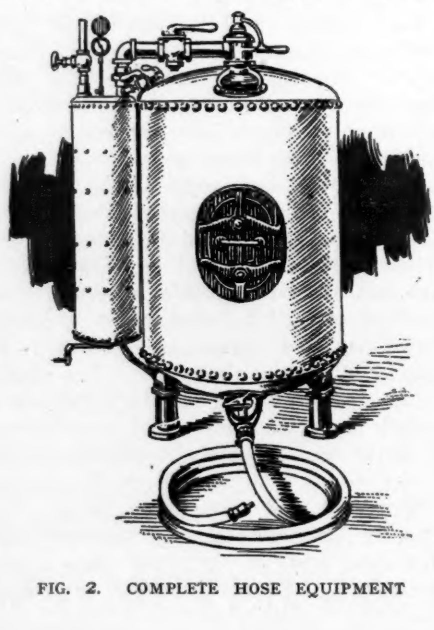


FIG. 2. COMPLETE HOSE EQUIPMENT

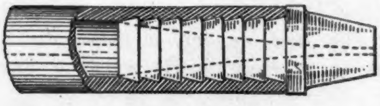


FIG. 3. ONE PIECE NOZZLE. MANGANESE BRONZE

time. This type of equipment is especially adapted for cleaning flat work, but is by no means limited to any particular kind of casting as it compares with the sand-blast tumbling mill in the variety of work it will handle.

THE TUMBLING MILL

The sand-blast tumbling mill is entirely automatic in its action and is especially adapted to handle small or medium parts of more or less irregular design. There are at least two types of this mill on the market; one of them horizontal and one tilted, Figs. 5 and 6. The object of having the barrel tilted is to impart a dual motion to the castings as the barrel rotates, so that every part will come into contact with the stream of sand, which enters through suitable nozzles located in the stationary head and, together with the dust and dirt from the castings, is exhausted through the lower end. The same theory is used in the horizontal mill by having false heads located inside of the stationary heads which give a lateral as well as a horizontal motion to the castings.

This equipment is adapted to jobbing steel foundries with a wide range of work and should be used in conjunction with the hose machine, or with the sand-blast room; the latter equipment to handle the larger pieces and the sand-blast tumbling mill to handle the

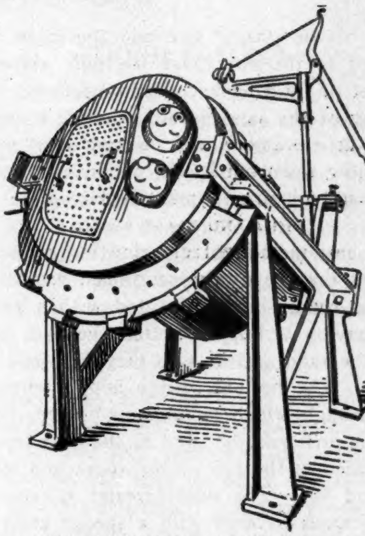


FIG. 5. TILTING TUMBLING MILL

small and medium-sized castings. It is estimated that a 50x40-in. mill will clean about 1500 lb. of small castings, on the gates, within twenty to thirty minutes, using No. 3 sand and air at 80 lb. pressure. The amount it is possible to charge into the barrel varies considerably with the class of castings. Pieces weighing 1 to 3 or 4 lb. take up more room than castings 8 to 10 lb., and our judgment is that if a machine will hold 1500 lb. of the latter it will not hold to exceed 1000 lb. of the former.

TAKING CARE OF THE DUST

The dust from these mills is exhausted by

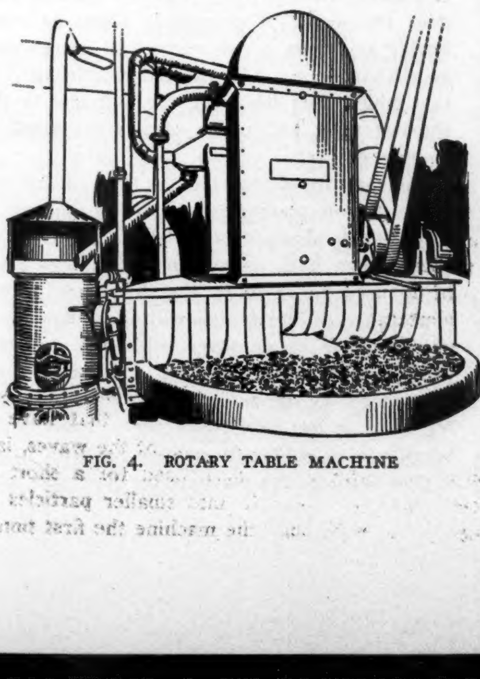


FIG. 4. ROTARY TABLE MACHINE

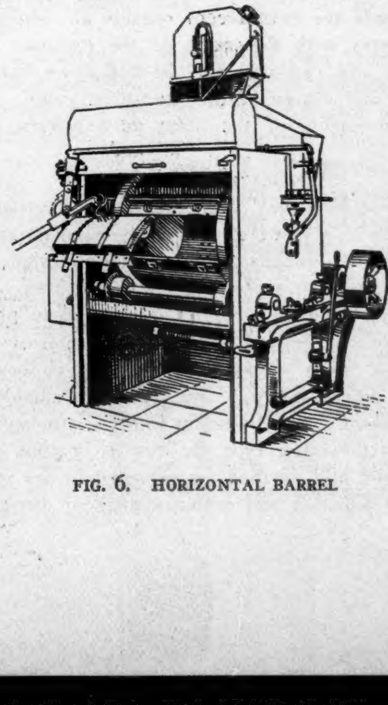


FIG. 6. HORIZONTAL BARREL

a fan of the proper size and the clean sand elevated to the bin above the mill, either by exhaust or by a bucket elevator system. The hoisting of the sand by air exhaust is preferable to an elevator whose working parts would be rapidly worn out by the action of the sand and would require frequent replacing.

THE SAND BLAST ROOM

The best method of cleaning large castings involves the use of the sand-blast room, Fig. 7. The room should be fitted with a grated floor having a hopper bottom beneath it to catch the sand and dust as they fall from the casting. The bottom of the hopper enters a pipe through which an exhaust system raises both the dust and the sand to the dust separator located at the top of the room and above the sand bin. The dust arrester consists of wood frames covered with a special grade of cotton duck. The dust passes through the screens leaving the clean sand to be returned to the sand bin and the clean air to the sand-blast room. The sand may be used directly from the bin by a hose or it may be returned to a hose sand-blast machine located within the room. The latter method is very satisfactory for jobbing steel foundry work as it enables the operator to stop or start at will, to control the hose with one hand and manipulate the castings with the other.

The sand-blast room may be built of brick, in which case it should have a wood paneling as the action of the sand on the brick wears the walls down very rapidly, or it may be of steel. In any case it should be tight enough to exclude the entrance of outside air which interferes with the work of the exhaust. No hard and fast rule may be laid down for the size and design of the sand-blast room. The requirements of the plant must govern each case.

VENTILATION IS IMPORTANT

Reference has been made to ventilation, which is a point to be clearly emphasized by means of exhausters of suitable design and centrifugal or screen type dust arresters. The former type of arresters is adapted to plants where it is desired to prevent diffusion of dust in the room where the equipment is located, and where it would not be objectionable to discharge a small amount into the atmosphere. With the latter type the dust is entirely suppressed and purified air returned to the room from which it was drawn instead of discharging into the atmosphere. This is a decided advantage and economy in the winter, as the necessity of continually warming incoming cold air is avoided.

THE QUESTION OF SAND

The grades of sand best suited for the different types of machines and character of work to be cleaned is a vital question. Here again the size of the foundry is a determining factor, and one which runs generally on small and medium-size castings and uses the smallest and simplest type of machine can use ordinary silica sand that has been washed perfectly free from dust and is perfectly dry. This is No. 1 grade. This is not the best sand to use, as being already a fine grain it is soon reduced to dust, but it is usually the easiest to obtain and costs so much less than the higher grades it is expedient for the small foundry to use it. The amount of dust which the fine sand creates would be a serious matter in a large plant, while it would not be very objectionable in a small one where the sand blast is only run two or three hours a day.

For the sand-blast room and the sand-blast tumbling mill, a grade of sand illustrated at the head of the article and designated A is recommended. This grade is about as large as can be handled satisfactorily by an exhaust system. It is sharp to begin with and does not require to be used and split up into small particles in order to get the maximum cutting effect. We have heard the contention made that the sharpness of the sand has nothing to do with the cleaning effect, that it is the force with which it hits the casting that does the work. This sounds about as reasonable as saying a dull razor will cut as well as a sharp one. The most desirable sand is that which does the work the best and in the shortest time, and which creates the smallest amount of dust.

The sand illustrations at the head of this article are from photographs made by the writer. The sand is abrasive material from Ohio, and it is shown both as new material, and after being used for a day; the difference in the appearance of the grains will show how they are reduced in diameter with use. Ocean sand, really smooth pebbles that have been worn down by the action of the waves, is better after it has been used for a short time, because it is split into smaller particles after it goes through the machine the first time and

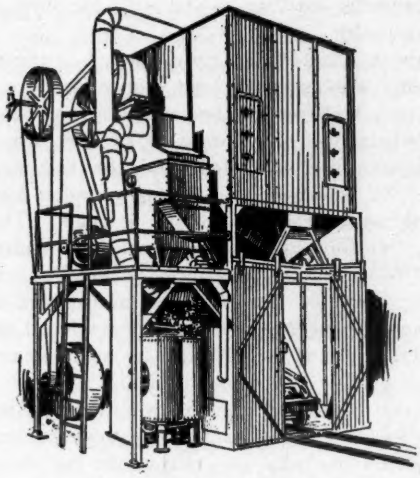


FIG. 7. SAND BLAST ROOM

the sharp edges increase the cutting speed. For foundries located at interior points, a long way from seaboard, the freight alone on ocean sand makes it rather expensive.

The adoption of the sand-blast has undoubtedly increased the cleaning room cost of the steel founder, but it has greatly improved his work, and the increased cost is more than compensated for in the saving in tool maintenance where castings are to be machined. Nothing is more injurious to machine cutting tools than the burnt sand on steel castings, and in these days of high prices for tool steels almost any expense necessary to remove the burnt sand is warranted.

THEY MEAN BUSINESS

All of the officials of Coleman-Shoemaker-Mead, Inc., Philadelphia, dealer in new and rebuilt machinery, and five other important men have voluntarily entered the service of the United States and the company will suspend its business after its present stock of machinery has been disposed of. The men who have gone into the service are as follows: R. F. Coleman, president, first lieutenant, Ordnance Department; F. F. Shoemaker, vice-president, United States Naval Reserves; C. S. Groove, 3rd, captain, U. S. Marines; Leonard Tissot, quartermaster, U. S. Naval Reserve; Rudolph Leibec, U. S. Naval Reserves; R. M. Harper, machinery inspector, U. S. Naval Shipping Board; Paul Tiers, Medical Corps, Naval Reserves.

HIGH FLYING*

At the beginning of the war the average height flown on active service was 4,000-5,000 feet, simply because few of the machines then in use, with the impedimenta carried, could get much higher. Today a height of 20,000 feet is, I believe, on certain occasions reached, and it is fairly certain that if progress continues at its present rate, heights a great deal beyond this figure will be reached as a usual thing.

THE COLD

These great altitudes bring forward many difficulties which will have to be seriously considered. The first trouble in the winter will be the extreme cold to which the occupants will be subjected unless they are protected by special cowling which will gather in the warmth given off from the engine. This, to a certain extent, is the natural advantage obtained in the tractor.

The question of the difference in the comfort of machines in this respect was shown to me in a very marked manner last winter. I was testing the fall-off of engine power at a height on a tractor two-seater in which it was specially arranged that the warm air from the radiator and engine passed along the fuselage to the pilot, and then to the passenger, and although at a height of over 21,000 feet with the thermometer below freezing at ground level, I did not suffer in the least from the cold, neither did my passenger, who sat behind, complain, until we shut off to descend.

As a contrast to this, a few days later, I was on a single-seater scout at an altitude of 17,000 feet, and although it was a tractor with a rotary motor, I suffered intensely from the cold, and became so numbed that my vitality must have been something akin to a dormouse under the snow, and, in spite of being well gloved, I had frost-bitten finger tips, which pained for many days afterwards.

Surely this is a very inefficient state for a pilot at the front to have to take on an air fight or other exacting work? Put two pilots up to a great altitude, one kept well warmed and comfortable, the other half dead with

*By Captain B. C. Hucks, Royal Flying Corps, in a lecture before the Aeronautical Society, London.

the cold, and it would be easy to surmise which would be most likely to do the best work.

I really believe it is more by accident than design that the pilot or passenger have benefitted at all in the past from the heat of the engine, with the exception, perhaps, of the late S. F. Cody's machine. He purposely placed the radiator of his pusher in front of the pilot to keep him warm. I know from my experience when flying in France in the cold weather that the discomfort owing to the extreme cold became intense when flying only at 6,000 feet on a two or three hours' reconnaissance flight.

This is a point which designers should give attention, especially as machines are now easily capable of reaching great heights. During summer weather, conditions would probably be tolerably comfortable, but in winter it would be well nigh impossible unless better arrangements are generally made.

During a recent heat-wave even, I have experienced cold of 20 degrees below freezing point at 20,000 feet.

Cold also affects the motor pretty seriously. This is more noticeable with the water-cooled type. Unless some provision is made for blanketing the radiator surface at heights, it becomes far too cold for efficient running. Cases are known of the freezing of the water system on a descent from a great height, with pretty serious results to the motor, as well as the difficulty of getting the engine to run again efficiently through being too cold to effect a landing. In the future war machine the pilot must have a very wide range of control over the water-cooling system.

RESPIRATION AND HEART ACTION

I will now touch lightly on effects that I have experienced on high flights. I have found the effect of high, *i.e.*, rarified, air to be felt slightly at about 10,000 feet, increasing with the altitude. Breathing becomes affected, respiration shorter and quicker, there is a curious oppressive sensation and a bulging feeling in the head until the height of about 20,000 feet is reached.

I am told by a medical friend who has made rather a study of the subject that there is always a risk of a sudden collapse, and oxygen should be used whether the aviator feels fit or not. Of course, the effect felt varies considerably with individuals, and with the state of one's health.

About eighteen months ago I suffered slightly with my heart, and found I could not get very high without feeling giddy, and after returning from a flight to 12,000 feet, I had palpitation, which lasted until the following day. In consequence, I had to abandon high flying until treatment got me fit again. This year I have made a number of high flights, and have felt no ill effects whatsoever; in fact, I find the more one gets accustomed to going up high the less the effects are felt. I am told that this also is the case in mountaineering.

I can remember the unpleasantness of my first flight to 15,000 feet. It was very marked, especially the pain experienced in the drum of the ears on descending. The fact that a flight now to 21,000 or 22,000 ft. does not have so much effect, I put down entirely to acclimatization.

USE OF OXYGEN

I use oxygen as a precaution when ascending beyond 20,000 ft., for the previously mentioned reason. A small bottle is carried, fitted with a special reducing valve, which is fixed in the fuselage within easy reach of the hand. No special regulation is required, as it is set to pass only the necessary amount of gas into the face mask which acts as a mixing chamber, with its inlet and outlet air valve.

The apparatus weighs 16 pounds, and contains sufficient oxygen for one hour's continuous use. After reaching 20,000 feet, I find it is only necessary to use the oxygen intermittently, and, accordingly, I simply hold the mask, after turning on the gas, over the mouth and nose, and take a few breaths of it, perhaps every half minute.

The effect to me is remarkable; most of the oppressive feeling vanishes, and, excepting for the unpleasant bulging feeling of the head, which you experience with a bad cold, the sensation is one of suddenly being again at ground level. The only after-effects upon landing from these high altitudes are that you seem to acquire a pretty good thirst, not a very serious hardship to many, due, I suppose, to the use of oxygen.

CAISSON DISEASE

If the speed of climb continues to improve at the rate it has for the past three years, it

looks as though aviators will become subject to what is known as "Caisson Disease," due, I am told, to the sudden reduction in atmospheric pressure, such as divers are subjected to when they come to the surface from a great depth, owing to the nitrogen which has been absorbed by the system, in proportion to the atmospheric density, forcing itself too rapidly at any lower pressure from the system.

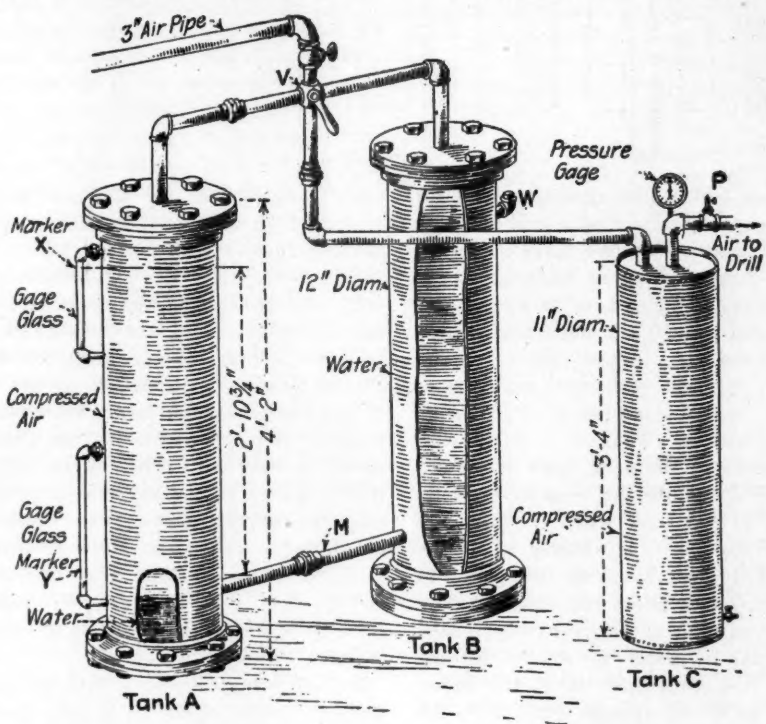


FIG. I

TESTING AND MAINTAINING THE EFFICIENCY OF DRILLS

BY H. H. HODGKINSON*

There is probably no company in the country that takes more pains to obtain the most efficient and up-to-date drilling equipment than the New Jersey Zinc Co., at Franklin, N. J. It was among the first to realize that efficiency in mining depends largely on supplying the men with efficient drills—machines which will drill rapidly; whose air consumption is low; whose maintenance is a minimum; and machines which, when put to work, will stay on the job. In the testing and development of drills, the company has gone to considerable expense, and judging from the results obtained, it has unquestionably paid to do so. When a new type of drill is received, every effort is made to get the best results in regard to drilling speed and air consumption that can possibly be obtained from that drill, and in addition the maker is given every assistance possible in his effort to develop a drill to meet the condition at hand. A drill-testing plant has been established in the mine for the purpose of obtaining accurate results in testing drills. This is situated in an abandoned pump station in the limestone hanging-wall. This white, coarsely crystalline limestone makes excellent ground in which to test the drilling speed of machines, having the advantage of being more homogeneous than the ore, while at the same time it has about the same drilling speed. The roof and sides of the old pump station afford an ideal place to test drills, making set-ups most convenient. Compressed air is delivered to the station by means of a 3-in. pipe at an average pressure of 95

*Mine Superintendent, Wharton Steel Co., Wharton, N. J.

The New Jersey Zinc Company

FRANKLIN, N. J.

DRILL RECORD

MAKE; ______ TYPE; ______ SHOP No. ______
PURCHASED ON REQ.; A B ______, 191 IN SERVICE; ______ 191 .
CYLINDER DIAM.; ______ Inches PISTON STROKE; ______ Inches PISTON WEIGHT; ______ lbs. ______ oz.
AVGE. DRILLING SPEED (to date) ______ Inches per min. AVERAGE AIR CONSUMPTION; ______ cu. ft. per min. free FACTOR; ______
ORIGINAL:— DRILLING SPEED ______ Inches per min. AIR CONSUMPTION ______ cu. ft. per min. free FACTOR; ______
PRESENT ( ):—DRILLING SPEED ______ Inches per min. AIR CONSUMPTION ______ cu. ft. per min. free FACTOR; ______

DATE		WORKING PLACE		DRILLING TIME		NO. HOLES DRILLED	FOOTAGE DRILLED	DRILLING SPEED IN FT. PER HR.	MATERIAL DRILLED	PCS. DRILL STEEL USED						HRS. REPAIR LABOR			REPAIR PARTS (Maker's Symbols)		M'T'CE CHARGES		
		Lev.	Loc.	Hrs.	Min.					1st	2nd	3rd	4th	5th	6th	Special	$2.25	$1.85			Supplies	Mine Labor	Mach. Shop Labor
Brought Over																							
1st	DAY																			N			
	NGT																			O			
2nd	DAY																			N			
	NGT																			O			
3rd	DAY																			N			
	NGT																			O			
4th	DAY																			N			
	NGT																			O			
	DAY																						

FIG. 2

lb. per square inch. The apparatus used for testing the air consumption of a drill is shown in Fig. 1. It consists of two tanks *A* and *B*, both of the same dimensions made by screwing blind flanges to the ends of 12-in. pipe and boring out and tapping the pipes and flanges to make the necessary connections as shown. Tank *A* is equipped with two gage-glasses upon each of which a marker is placed at an interval of 34¾ in. Tank *B* is filled with water by means of the ¾-in. pipe *W*, which is fitted with an elbow and plug to facilitate the refilling of the tank when required. A 1½-in. four-way valve is situated at *V*, by means of which compressed air is supplied to the small receiver *C*, alternately from tanks *A* and *B*. When tank *A* starts to supply air, tank *B* is full of water as shown and the meniscus in the gage-glass is at the lower marker *Y*; as the air passes out of *A*, the water in tank *B* flows through pipe *M* and rises in tank *A* until it reaches the upper marker *X*; in the meantime the volume of water which passed over into tank *A* has been displaced by an equal volume of compressed air. The valve *V* is then reversed quickly by means of the lever, and the water gradually returns to tank *B*, the air displacing the water in tank *A* until the meniscus in the lower gage-glass reaches the marker *Y* and so on. The water is colored so that the mensicus is clearly defined in the artificial light. To facilitate the passage of the water back and forth between *A* and *B*, pipe *M* is 2 in. diameter, while the remainder of the piping is 1½ in. The third tank *C* is a small wrought-iron receiver which acts as an equalizing reservoir and supplies air to the drill at a more constant pressure and in addition catches any water in the air, or water which might have possibly come over from tanks *A* or *B* in case the four-way valve has not been closed properly, thus preventing the water from reaching the drill. This tank makes it possible to read the pressure gage mounted at the top of the tank more accurately, as the indicator of the gage does not flutter with each movement of the valve of the drill, as would be the case if it were not in the system. At the bottom of tank *C* is a small pet-cock to drain any water so that the volume of the receiver is not cut down, in addition to keeping it away from the drill. At *P* another small pet-cock is inserted for the purpose of raising or lowering the water in the tanks to the markers in order to start a test.

By using these tanks in testing a drill, the volume of compressed air is kept constant for each run, while the time, inches drilled and air pressure are the variables; that is, five tanks of compressed air are supplied for a run which is equivalent in this case to 11.38 cu.ft. The time required by the drill to consume this amount of air, the inches drilled and also the pressure in pounds per square inch are recorded. A 1¾-in. raised-center cross-bit is the standard used for testing purposes, and the condition of the bit at the end of each run is noted as being either fine, good, fair or poor. Good results cannot be obtained when the drill bits are poorly made. The air consumption and drilling tests are recorded as shown in Fig. 2. The factor obtained in the last column is of great value in comparing different types of drills. In addition to the care in testing drills when first received, the company has

gone further by keeping a permanent daily record of each machine.—Eng. and Min. Journal.

A STEAM HAMMER CONVERTED TO AIR

The Cumberland County Power and Light Company of Portland, Me., has recently been successful in the conversion of steam-hammer equipment to electro-pneumatic service, a pioneer installation being made at the plant of the Marine Hardware and Equipment Company. At this plant a 1200-pound Bement-Niles steam hammer was in service, steam at about 90 pounds per square inch being required for many hours daily. To avoid condensation troubles, it was necessary to run the hammer practically continuously. As electric-motor drive had been adopted for other purposes throughout the plant, it was found possible to do away with the demand for continuous high-pressure steam by adapting the steam hammer to air operation and installing a motor-driven compressor to supply air for this purpose and other requirements. The valve of the steam hammer was rebuilt for a fit of 0.0025 inch compared with a previous fit of 0.005 inch under steam service. The Hardware company purchased a 50-horsepower, 220-volt, three-phase, Westinghouse squirrel-cage induction motor designed for 900 revolutions per minute, and belted it to a 12-inch and 7-inch by 12-inch compressor delivering air at 90 pounds to the storage tank supplying the compressor. A branch exhaust terminating at two ½-inch pipes was led down the frame of the hammer to outlets directed upon the working anvil surface, so that all chips and scale are immediately blown away in operation. It was found that harder and quicker blows could be struck than under steam conditions.—*Journal Franklin Institute.*

A PISTON AREA CHART

The following article by N. G. Near, reproduced from Marine Engineering, October, 1917, should be doubly valuable in steam driven air compressor computations since it is equally applicable to both ends of the machine.

To subtract the area of the piston rod has always been a sort of "pest" for engineers in general when making computations for horsepower directly from indicator diagrams. The head end of the cylinder has always been easy

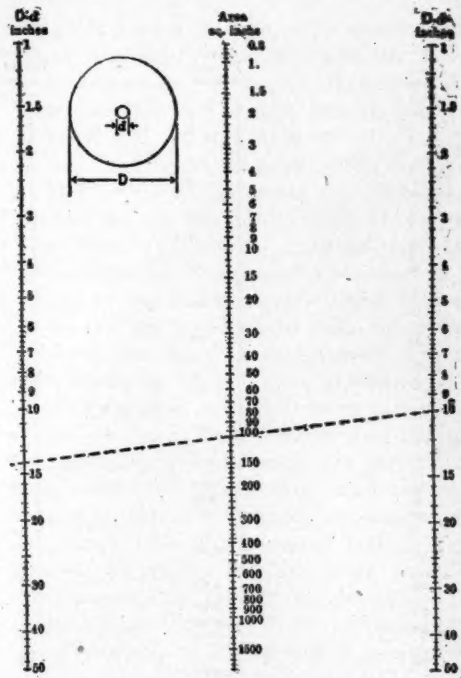


FIG. I

enough to work out, but the crank end invariably contains that infernal piston rod.

The other day I hit on a scheme for lightening the labors of making computation of this sort, and prepared Chart No. 1 for that purpose. I believe the idea is "brand new" and it works as follows:

Where D = diameter of cylinder in inches, and d = diameter of piston rod in inches, just add D and d and find the corresponding figure in the left-hand column of the chart. Then subtract d from D and find the corresponding figure in the right-hand column. Connect the two figures with a straight line and the middle column gives the area with the piston rod area already subtracted.

If the chart isn't accurate enough for you it will at least tell you whether or not your long-hand figures are "anywhere near accurate."

For example, I have chosen a 12-inch cylinder and a 2-inch rod. My figures, therefore, are 14 and 10, and the middle column shows the area to be very close to 108 square inches. Computed the long-hand way, I find the area to be actually 108.2 square inches. So the chart is fairly close.

The chart can also be used just as readily for finding the area of the head end of the

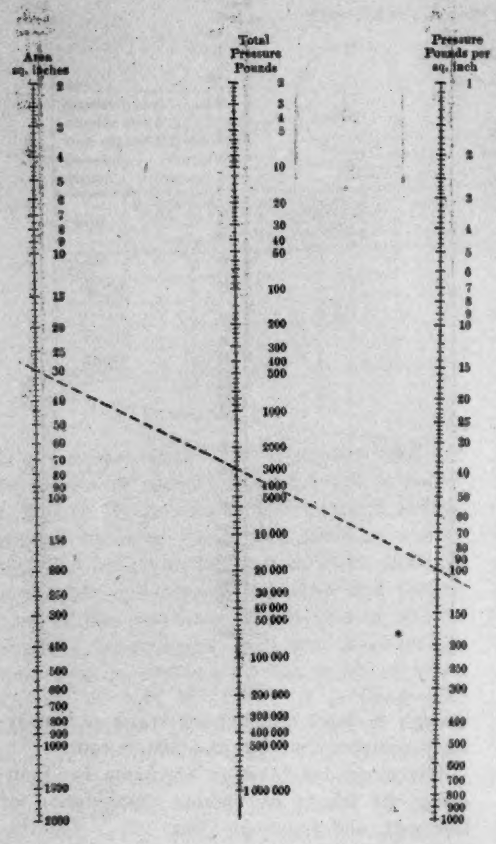


FIG. 2

piston. In that case $d = 0$, and we have to use D in each column.

For example: Find the area of a 10-nich circle. Just connect 10 in the left-hand column with 10 in the right-hand column, and the intersection will come close to 78. Mentally, perhaps, you can figure that the exact area of a 10-inch circle is 78.54 square inches. It happens to be exactly equal to 25 Pi.

"Area × Pressure" Chart

After finding the area of the piston we always have to multiply by the "mean effective pressure." To lighten that task, or at least to make you sure of your figures and decimal points, Chart No. 2 was designed.

The chart is very simple and needs no further explanation. The dotted line drawn across shows that 30x100 = 3000. The range of the chart is wide enough for any steam pump or air compressing problem inside of 1,000 lb. per sq. in.

POWER-LOSSES IN PNEUMATIC TIRES

The result of a series of experiments on the power-losses in pneumatic tires were discussed at a meeting of the Pennsylvania Section of the Society of Automobile Engineers, by E. H. Lockwood. It was found that while the rolling resistance varied considerably for different kinds of tires, it was practically constant for a given tire for all speeds up to 40 miles per hour, the highest speed which the conditions of the experiments allowed. The distribution of internal power-losses was found to be as follows: A six-cylinder Chalmers chassis was used, the tires were 32 by 4 in., the load on the front wheels was 1145 lb., the load on the rear wheels was 1545 lbs., and the tire-inflation was 75 lb. per square inch. Rolling resistance:

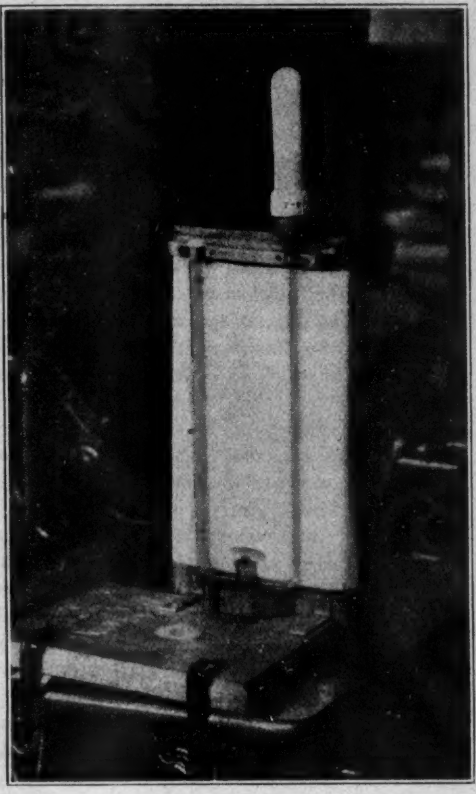
	lb.	Per cent.
Front tires	18.2	31.2
Rear tires	17.7	30.3
Front bearings	4.7	8.0
Rear bearings and transmission	17.9	30.6
Total	58.5	100.0

TWO NEW AIR MEASURING INSTRUMENTS

The instruments here spoken of were mentioned by Mr. George T. Palmer in an address before the New York Chapter of the Heating Engineers and attracted much attention. The account here presented is obstracted from The Heating and Ventilating Magazine, September, 1917.

THE ATMOMETER

The first of these instruments, shown in the halftone above, is for the purpose of measuring the drying or moisture absorbing power of the atmosphere under varying conditions of pressure, temperatures, etc. It consists of a slim cup of porous material, seen projecting at the top of the instrument, which is attached to one arm of a glass U-tube with the free arm graduated in tenths of a cubic centimeter. The apparatus is prepared for use by filling the cup with distilled water, to which a trace of copper sulphate has been added to prevent the growth of molds or small plant life. The capillary arm of the U-tube is then inserted in the cup, the arm being filled with



THE ATMOMETER

water up to the stop cock. These parts are held together by the rubber stopper which makes a water-tight joint.

The instrument is now inverted with the porous cup uppermost, as seen in the half-tone, the graduated arm of the U-tube is filled with water and, on making sure that no air bubbles have been entrapped, the instrument is ready for use although sufficient time should be allowed for the water to make its way through the porous cup before observations are taken.

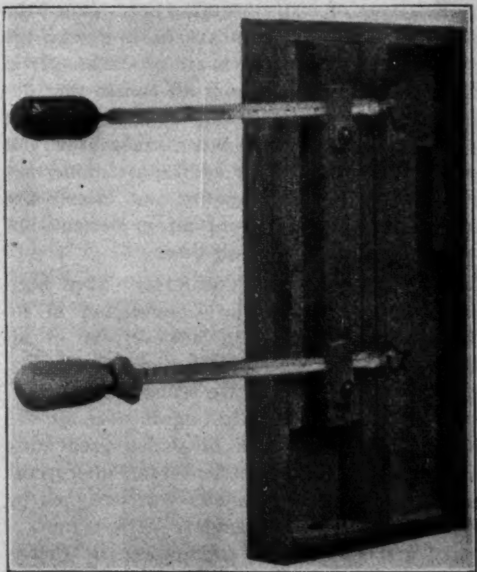
As water evaporates from the surface of the porous cup, more water flows up through the capillary arm to take its place. The amount of water evaporated in a certain time is read off directly from the water level in the graduated arm.

The instrument is useful in measuring the relative drying effects of air at various temperatures, humidities and rates of air movement. It has been used by horticulturists in studying the effects of dryness and moisture on plant growth, and its use is described in a paper entitled "Atmometry and the Porous Cup Atmometer," by B. E. Livingston. This paper and the Cup may be secured from *The Plant World*, Tucson, Arizona.

THE KATA-THERMOMETER

This instrument measures the combined effect of the three modes by which air abstracts heat from a hot object: radiation, convection and evaporation. It consists, as seen in the photo, of two elongated glass bulbs filled with a colored spirit, one of the bulbs being cloth-covered and the other uncovered. The tubular stems of the bulbs are graduated in degrees Fahrenheit to read from 95 to 100. The bulbs are placed in hot water until the spirit column rises well above the 100 degree mark. The uncovered bulb is then dried and either placed in the rack provided or suspended by a string. The cloth covered bulb is gently shaken to remove any excess of water and then exposed the same as the dry bulb.

Both bulbs lose heat to the surrounding air, and their rate of losing heat is measured by timing the spirit column in its fall from 100 to 95 degrees. Each bulb has a coefficient which is divided by the time of fall in seconds, and the quotients obtained, when added together, express the heat extractive power of the air in terms of calories per square centimeter per second.



THE KATA THERMOMETER

The kata-thermometer is useful in measuring the deheating effect of the atmosphere during the time the reading is being made. It is not possible with this instrument, however, to follow the slight fluctuations in deheating effect which are constantly occuring. Prof. Phelps, of the New York State Commission on Ventilation, has attempted to meet this situation with a wet-bulb thermometer to which a constant amount of heat is supplied through an electrically-heated coil. If the heat production is constant then any change in the rate of heat loss must show itself in the actual temperature of the instrument. If the air temperature and relative humidity are high and the air movement is slight, the rate of heat loss from the heated bulb will be slow and, inasmuch as the amount of heat supplied does not change, the mercury column on the thermometer will rise up to a point where its rate of heat supply and heat loss is balanced. Heat is thus being stored up in the instrument.

In a cold atmosphere heat is taken away from the bulb about as quickly as received and the mercury column does not get an opportunity to rise. The fluctuations in rate of heat loss may then be determined by reading the mercury column at intervals or by fitting up a bulb on a recording psychrometer and thus obtaining a continuous inked record of the heat loss changes.

This type of instrument has been named the "Comfortmeter" as it measures, in a way, the degree of comfort which air produces. It is the rate of heat loss from all causes that determines body comfort and this instrument as does the kata-thermometer, measures not merely the temperature of the air alone, not merely its relative humidity, not merely the velocity and constancy of air movement, but the combined effect of all three.

Two forms of the "Comforter" have been used by the Ventilation Commission in its work. This instrument, however, is in an early stage of development and any further details of construction are without special interest at this time. The significance of the readings and the form of scales used must also await further experience for interpretation. The kata-thermometer was designed by Dr. Leonard Hill, of London. It is manufactured and sold in this country by the Fiebe-Gorman Co., Monadnock Block, Chicago, Ill.

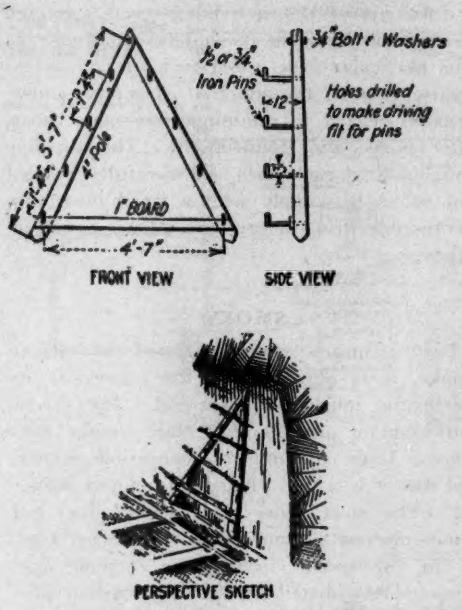
UNDERGROUND DRILL RACK

The use of hollow steel in rock drilling has brought its special disadvantages, one of which is the tendency of the water hole to become plugged with sludge and grit. When this happens it causes a delay to the miner, who usually tries to clear the hole and use the drill if possible. When he is not successful, which is usually the case, it means that the drill can not be used until it has been returned to the blacksmith shop, cleared and sent down again. When a large number of drills are to be sharpened, the fact that a drill is plugged but not dulled will escape the notice of the man at the forge; and the result is an entirely superfluous re-sharpening and re-tempering of the steel. Such complications add to the expense of operating rock-drills when this kind of steel is used.

There are various ways by which hollow steel is caused to become plugged. The chief one is the manner in which it is handled underground. A trip through the mine will show a surprisingly large number of drills lying around in the dirt. This affords an excellent opportunity for material to lodge in the hole, causing it to choke. Miners, for convenience, will stand their drills in a row along the wall, thereby facilitating the entrance of dirt in the end standing on the ground. It would seem impossible to prevent this evil unless suitable racks are provided. Many types of racks are in use but most of them are permanently fixed in one place. This is a disadvantage in drifting operations in which the miner gets farther away from his drill rack as the drift advances. If a new rack is not built in a more accessible spot, he will keep his drills nearer his machine any way, and they will soon be lying around or standing up in the dirt again.

To overcome the difficulty, the rack shown in the illustration was designed. It consists of two poles fastened together at the top with a bolt and properly distanced at the base by a board. The iron pins on which the drills are supported are driven into holes previously bored in the poles and can be made of scrap material. The distance board at the base has a large hole bored at each end, which permits the board to slip down over the bottom pins of each pole.

The whole rack can be easily and cheaply



UNDERGROUND DRILL RACK

built and may be taken apart by removing the bolt and slipping off the baseboard. This makes it a one-man job to move from one place to another.

A glance at the sketch will show that drills of different lengths may be kept separate, and the bits and shanks can be inspected without picking up each drill. This saves time for the miner and facilitates the work of the nipper or any other man responsible for the distribution and care of drills.—*Eng. and Min. Journal.*

SPEEDING UP THE DRILL

Considerable discussion and effort has taken place in an attempt to get more work from machine drills. There are many ways in which this may be accomplished but also many obstacles when it comes to active practice. It is the object of this article briefly to outline some of these methods and to describe one in particular.

In analyzing the cost of breaking rock it has been found that the greatest item of expense is miners' labor, and the labor situation of today is such that it is poor policy to try and get any more work out of a man. The only way out of the difficulty is to make it possible for a man to do more work without expending any more energy. In view of such considerations methods of speeding up the drill seem to offer the best solution and group themselves under the following heads: (1) Increasing the actual drilling time of the machine. (2) Increasing the reciprocating speed of the machine.

The importance of the first factor is realized by few. A little time spent with the stop watch will show that machines are actually operated from 25% to 50% of the total shifts' time, or from two to four hours of the customary eight. Personally, I have never known one to run as high as four hours out of eight. The rest of the time is spent in various other operations, such as "mucking back," mounting, changing drills, moving the machine, tearing down, loading and firing the holes, etc. All these things have to be done by the miner and take up a large part of his shift.

The diminution of such delays must be made according to the conditions in various places. In a general way only a careful study of delays will suggest remedies. In many cases lighter machines and mountings can be used to advantage. In drifting the miner's greatest delay is mucking out a place for his post. Where there are two 6- to 8-ft. wide drifts not too far distant on the same level, the following is a good time-saving method:

Instead of using one machine per shift in each drift, work both machines in one drift on the day shift and move them to the other on the night shift. In the mean time the first drift is mucked out and ready for a clean start on the following day shift. This adds from one to two hours to the available drilling time. Needless to say, the miners are glad to be relieved of the strenuous mucking at the start of the shift. There is no additional labor involved in this arrangement and it is only impracticable where the ground is so soft that there is not enough drilling in a round of holes to keep two machines busy for a shift. Careful attention to the supply and quality of drill steel will also help to increase the machine's running time. These are merely suggestions and may not apply in all cases. Some day the rock-drill manufacturers will devote more time and study to the designing of a machine that will facilitate the changing of drills and other operations that mean lost motion to the miner.

In the second method of speeding up the

drill it is evident that, if a machine is only reciprocating from two to four hours in a shift, everything should be done to get a maximum amount of hole drilled in that time. This means a close study of different types and makes of both machines and drills to determine what is best suited to the ground. There are several makes of machines on the market as well as a diversity of opinion as to which are best. That is a question that can only be decided by experiment in each case. The same applies to various types of drill bits. Of course, a small hole can be drilled faster than a large one and here we have the big advantage of the Carr bit with its small gage changes. On the other hand, a small hole will not hold so much powder. In the latter case the solution is either to use stronger powder or place a smaller burden on each hole. The powder solution is preferable, of course, but there are mines where the ventilation is too poor to care for the larger volume of fumes that come from powder of greater strength.

There is one thing that will increase drilling speed in all cases and that is getting every available pound of air pressure behind the hammer. Pressure-drop through pipes, hose, inlet ports, etc., has been carefully measured and recorded, but there are still a surprisingly large number of mines where no attention is given to such matters. To put the loss in drilling speed into something more tangible than merely the pounds drop in pressure, an interesting test was conducted.

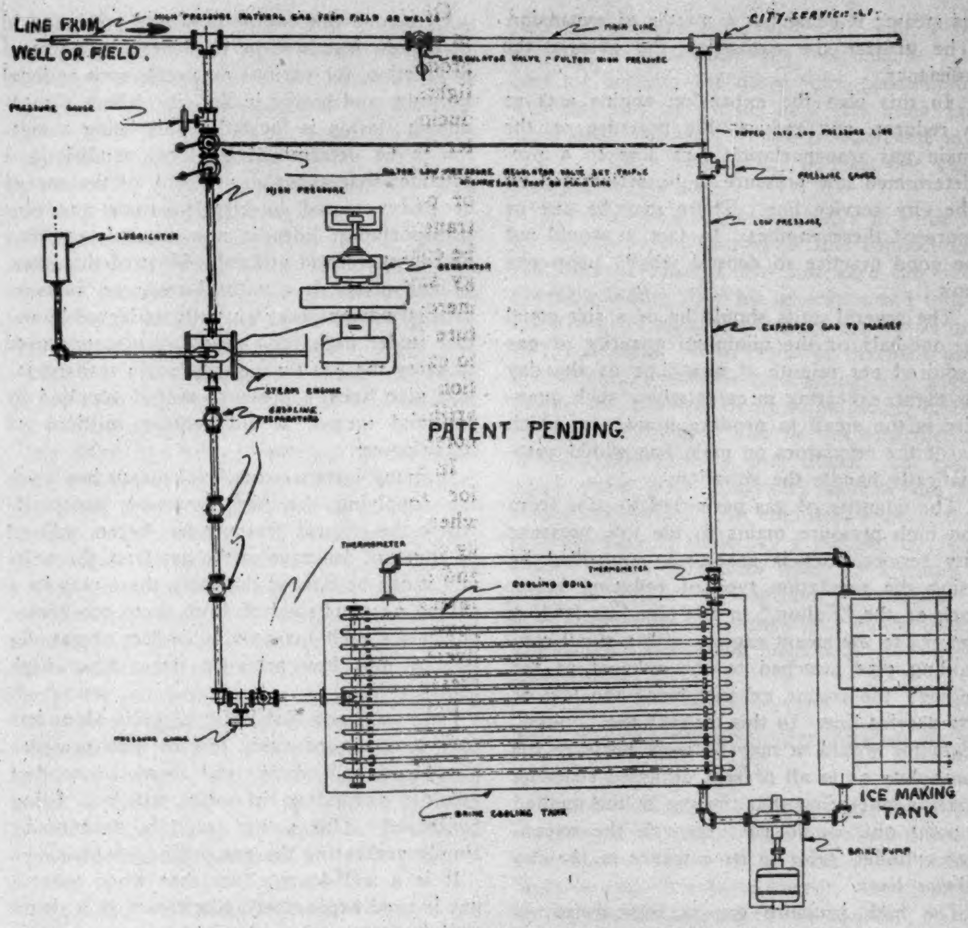
A place was selected where there were two machines in good condition, supplied with air through oversize pipes to insure a maximum pressure. A globe valve was inserted in the pipe line near the machines, and a pressure gage attached between the valve and the machines. For an entire shift the pressure was kept down to 55 lb. by manipulating the valve, and the drilling speed of the machines recorded in the usual manner. The next day the test was repeated with a constant pressure of 70 lbs. This 15-pound increase in air pressure increased the drilling speed by 37 per cent. By drilling speed is meant inches drilled per minute of actual reciprocating time. The result obtained was almost startling although the test was simple and easily performed. A 15-lb. drop in pressure is quite common in conducting compressed air through pipes, but a difference of 37% in drilling speed is enough to make anyone "sit up and take notice." In this particular case it led to a careful investigation and to the adoption of certain standards in regard to minimum size pipes, hose, inlet ports and connections. The air-pipe equipment of each level was carefully worked out so as to comply with a fixed maximum permissible drop in pressure.—*Eng. and Min. Journal.*

SMOKE

Before means can be found to reduce smoke, it is obvious that the causes of its production must be understood. The erroneous opinion prevails that black smoke contains a large amount of combustible matter, and that it is a sign of greatly reduced economy. The most dense black smoke does not commonly contain more than ½ of 1 per cent. of the combustible fired. The extreme fineness and the distribution of the carbon particles bestow upon them a high coloring power. The losses are negligible in comparison with those due to incomplete combustion or excessive air, which generally accompany combustion without visible smoke. The carbon particles producing visible smoke are not derived from a lifting of fixed or solid carbon from the grates, but they are formed from gases during the combustion process.—*Power.*

OFFICIAL LIST OF MINE-RESCUE EXPERTS

The Bureau of Mines, Department of the Interior, in a report just issued prints as a roll of honor the names and addresses of the miners throughout the country who have taken the bureau's course in mine-rescue work from July 1, 1914, to June 30, 1916. Copies of this report are being sent to every mine operator and state mine inspector in the country, in order that in the event of a disaster in his district or at his mine, he will be able at once to determine the nearest available trained men for rescue work. Mine owners in the past have cooperated in this manner as much as they could, but have sometimes been badly handicapped and delayed in endeavoring to learn which miners have been trained in rescue work. The report gives the names and addresses of more than 3,000 men.



POWER AND REFRIGERATION FROM HIGH PRESSURE GAS

MECHANICAL POWER AND REFRIGERATION FROM HIGH PRESSURE GAS

Natural gas which is now transmitted in great volume and for long distances is also during transmission under heavy pressures, say from 50 lb., gage, up to 300 lb. or over. For profitable transmission the high pressures are imperative, as permitting the use of pipes of comparatively small diameter, and this pressure may be the natural high of the gas at the wells or it may be due to the employment of boosting compressors at certain points on the line. In either case before the gas is distributed for service the pressure is nearly all released so that only 6 or 8 ounces remain.

In this reexpansion of the gas before use there is a great opportunity for power development and also for useful refrigerating effect which thus far has not been realized except in a few exceptional cases. This matter is discussed in a paper by Auguste Jean Paris, Jr., printed in Natural Gas and Gasoline.

This is, he says, an efficiency problem pure and simple. Efficiency at the reducing station, which also may be made to increase the efficiency of the compressor station while supplying at the same time several products of value, such as power, gasoline and ice.

The reducing station, which I suggest, is one to take the place of present design, and consists of engines, similar to steam engines, wherein gas under pressure would be used instead of steam.

Every engineer knows that gas, under pressure, will drive a "steam" engine just as well

as steam; it being but a matter of expansion. The greater the expansion the greater the efficiency.

In this plan the expansion engine acts as a reducer, and reduces the pressure on the main gas transportation pipe line to a predetermined low pressure to be maintained on the city service line. There may be one or more of these engines. In fact, it would not be good practice to depend wholly upon one unit.

The several units should be of a size equal to one-half of the minimum quantity of gas required per minute at any time of the day or night, excepting in cases where such quantity is too small to produce power, in which event the regulators on main line would automatically handle the situation.

The quantity of gas permitted to pass from the high pressure mains to the low pressure city service lines is absolutely controlled by using the regulation type of reducing valve, such as the "Fulton," in the pipe-line leading the gas to the steam engine, with a small controlling pipe attached to the exhaust of the engine; the engine exhaust being the low or city service line. In this manner the "Fulton" regulator would, it may be seen, perform the same duty as in all present designed reducing stations, excepting that the gas in the method I point out, would pass through the expansion cylinder, *prior to its entrance to the city service lines.*

The high pressure gas in this system is made to do work on the piston, or other moving part of a reciprocating or turban expansion cylinder of the engine, thereby producing power as pointed out, through the reduction of the pressure from the high pressure of the main gas transportation pipe line to the low pressure of the city service pipe line.

The utilization of this lost power represents a conservation of natural and artificial resources, which up to this writing have been wasted, and for instance this power can be used for a variety of purposes, generating electricity, which, in turn, may be delivered back to the compression station and there used to drive part of the compressors supplying possibly 40% of the power required in such station.

This plan obviously increases the efficiency feature of the gas compression station by at least this same 40 per cent.

Of course this engine-produced power could in certain instances be used near its point of production, for various purposes, such as local lighting, and power in the city, where the reducing station is located. This being a matter to be determined by local conditions, I consider that about 40 per cent. of the energy or power stored in high pressure gas pipe transportation lines is now wasted, yet may be conserved and utilized. Most of this energy and power is a natural resource, as commercial natural gas is usually delivered by nature under high rock pressure, pressure used to carry the gas through the main transportation pipe lines, a pressure that if supplied by artificial means, would require millions of horse-power.

In many instances artificial means are used, for supplying the high pressure, especially where the natural pressure has beeen reduced by constant drainage of the gas from the wells and it can be figured that here there may be a saving accomplished of from 50 to 100 horsepower for each 1,000,000 cubic feet of gas delivered into low pressure lines, from high pressure lines.

I am informed that West Virginia alone has over 2,000,000,000 cubic feet of high pressure gas being sold daily, and many times that quantity bottled up in wells, which is being conserved. This power could be doubled by simply preheating the gas prior to expansion.

It is a well-known fact that when natural gas is used expansively, like steam, in a steam engine, it not only reduces the pressure from high to low, in the power generating process, but also that the temperature of the gas, is lowered, whereby refrigeration may be produced.

It is possible to produce a temperature of 100 degrees below zero F. or lower. Therefore, under these conditions, the pressure reducing engine may become a refrigerating machine. The exhaust or low side, of the expansion cylinder, delivers gas into the city service not only at any predetermined pressure, but at a very low temperature.

Located in the exhaust line, leading to the city service line, I suggest placing separating devices, the function of which would be the separation of any condensible vapors, such as gasoline, etc., under temperatures, such as those produced, in this operation, thus all gasoline, etc., will drop out of the gas:—abso-

lutely all of it; for there can be no other means as efficient, in this respect, thus supplying, as supplemental to the main object of this process, a gasoline plant to recover such of this material of great commercial value as may remain in the gas after earlier extraction at extraction plant, or where recovery may not have been earlier attempted.

The gas, leaving the gasoline station, having lost none of its refrigerating effectiveness, can be used for ice making, by passing the cold gas through brine (just as in an ice plant), the brine in turn refrigerating the water, and producing ice; the gas then being delivered through the city service lines to the consumer for heating and lighting.

My point has been to produce power, gasoline and ice, by machinery consuming no fuel increasing thus both the efficiency at the compressor station, and at the reducing station—efficiency, as it were, both coming and going; a dual conservation of natural resource.

Power, gasoline and ice are produced by this plan right at their market, in a city's suburbs, at no additional cost. It is simply utilizing the power inherent in the gas itself, saving waste-energy, and making it do work.

The entire station works like a by-pass, around a present style reducing station, which is not disturbed, but left ready to perform its work as of old, with the added efficiency, of new, and scientific methods.

THE LOW BID

The contracting business is sorely afflicted with a custom. This custom is a blight, a killing frost, a curse. In parliamentary language this troublesome agency is called the low bid. The low bid is one of our cherished institutions. It is lovely in theory. In practice it is as a monkey wrench hurled into the machinery of construction. Everything would be lovely if it were not for the fact that a fool is born every minute and that an amazing number of them born into the contracting business. Knowing nothing whatsoever about costs they keep bidding until they are decidedly low on some job. Owing to the prevailing willingness of city officials to sting the contractor on occasion, the ridiculously low bidder is awarded the job. Lacking experience and an organization he is soon head over heels in a dozen kinds of grief. He throws up the job or stays on and goes broke. This makes for poor construction, delays completion, increases costs and balls things up generally. Meanwhile the responsible bidders are looking for other jobs, occasionally winnning out, of course, at a fair price, but being often thwarted by the irresponsible low bidder. There is generally at least one such bidder at every letting.

Isn't it about time for engineers to come to the rescue of contractors in this connection? For humane reasons why not save the irresponsible bidder from his ignorance and folly? He is a good man, as often as not, but is out of his element. With credit at the bank and an inclination towards contracting, and a desire to win the supposedly large profits in the business, he takes a flier in the construction business and speedily goes broke. Let engineers warn their employers against the irresponsible bidder. Let engineers explain that it never pays to underpay a contractor. The owner invariably suffers when an attempt is made to gouge the contractor, especially a contractor who is incompetent, inexperienced and not any too strong financially.—*Municipal Engineering.*

THE AIRPLANE RECORD KEEPS MOVING

The recording of airplane records is the business of the daily rather than the monthly publication. The possibility of trans-Atlantic flight is rapidly coming nearer. On September 24 Captain Marcus Giutio Laureati, of the Italian air service, carrying one passenger, flew from Italy to England without a stop. He left Turin at 8.28, Italian time, and landed at Hounslow, a suburb of London, at 2.50 p. m., 656 miles in 7 hours 22 minutes, or an average rate of approximately 90 miles an hour. Captain Laureati flew an Aila machine, and carried two machine guns. From Turin he followed the railroad as far as Susa, on the Italian frontier. Crossing the Alps (Mont Cenis) at an altitude of nearly 12,000 feet, he passed over Lanslebourg and followed the railroad from Modane. He passed to the east of Paris, and crossed the English Channel in 15 minutes. He carried an autograph letter from his King to King George. During the flight he took food from a bottle fastened inside his coat and fitted with a rubber tube like an infant's feeding bottle. On August 26 Laureati flew from Turin to Naples and back, a distance of 920 miles, without a stop.

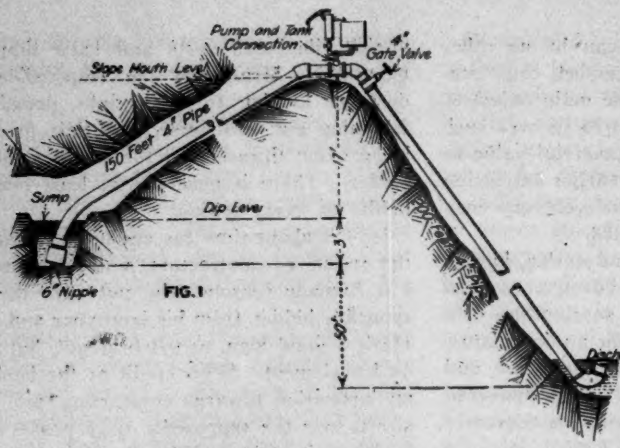


FIG. 1

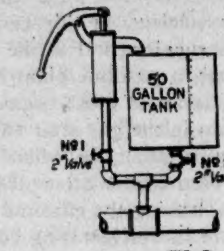


FIG. 2

THE SIPHON IN THE MINE

SIPHONING MINE WATER

BY JACK L. BALL

Except by natural drainage, the simplest method of taking water from a slope mine, mechanically, is by siphoning. At times this may develop some uncertainty of action but with a little care in installing a siphoning apparatus, together with a slight knowledge of hydraulics, one ought to experience but little trouble.

The first thing necessary is pipe of a diameter sufficient to carry off the water as fast as it collects; the next is to have the siphon air-tight; then to see that the pipe is leveled properly; that is, that there are no depressions in the line which will cause air pockets to form, as this seriously interferes with the successful operation of the siphon. See that the discharge end of the siphon is well below the suction level, the more the better.

Theoretically, the height to which water can be raised, conditions being perfect, is 34 ft. At this distance there would be no flow, because the pressure on the discharge side would balance the pressure required to raise a column to this height, which is the atmospheric pressure taken at sea level—14.7 lb. To achieve good results one should not go over 25 feet.

Figs. 1 and 2 illustrate a siphon that was installed in a slope mine in western Pennsylvania, and to the writer's knowledge this was operated very successfully for several years. Referring to Fig. 1: From the slope mouth to the bottom of the dip the lineal distance was 150 ft., and from the sump bottom level to the slope mouth level the height was 20 ft. From the highest point of the siphon to the end of the discharge line the distance was 200 ft., and the vertical drop was 70 ft. Four-inch pipe was used throughout, except a 6-in. nipple 1 ft. long, which was put on the end of the suction to insure an unrestricted flow of water at that point. When necessary the pipe was bent, and ells were used only at the end of the discharge.

Fig. 2 shows a bucket, or common-well, pump and a 50-gal. iron tank connected to the siphon slightly beyond the highest point, with 2-in. pipe and fittings. To start the siphon, valve 1 was opened and the pump operated until water was pumped out, the surplus going into the tank, thus insuring a tank full of water at all times. The 4-in. gate valve shown in Fig. 1 was then opened and the valve in the pump line closed.

The tank was connected in the same manner as the pump, kept full of water, or nearly so, and when at any time the flow of water from the siphon became intermittent valve 2 was opened, letting enough water into the line until the flow became steady again. At the end of the discharge line, Fig. 1, an ell was placed together with a 4-in. nipple 1 ft. long. One of the characteristics of a siphon is that unless precautions are taken air will enter at the discharge end, work gradually back in the siphon to the suction end and break the flow. To prevent this the ell was placed in the position shown, with the nipple almost vertical. This acted as an air seal and eliminated almost entirely any air that might have entered at this point.—*Coal Age.*

BRAKE PIPE LEAKAGE AND COMPRESSOR CAPACITY

BY C. R. WEAVER*

The whole question of brake pipe leakage resolves itself into what quantity of air may be permitted to escape from the brake system and still permit charging, maintaining and replenishing the brake system in such time as will not impose limitations upon traffic in the way of delays, getting trains ready in the yard, and operating them over the road.

It is very difficult to ascertain what quantity of air is actually leaking out of the brake system. It is not difficult to find out what drop takes place in the pressure, but this varies owing to variations in methods of making tests, positions assumed by triple valves, etc. It is not difficult, however, to fix on some quantity of air that may be permitted to leak out of the brake pipe and then supply in the yard this quantity of air to a train previously charged and observe whether or not the quantity supplied does, or does not, maintain the required pressure. If it maintains or more than maintains the pressure, it is apparent that the leakage of the train is no more than can be permitted. If it does not maintain the pressure then the leakage must be reduced to the point where it can be maintained. The permissible amount of leakage from the entire brake system is the starting point. Too much leakage must not be allowed or an undesirably large compressor capacity or high degree of compressor maintenance will be necessary. An excessively low amount of leakage must not be insisted upon, or traffic will be interfered with on account of the time required to stop the leaks.

In order to arrive at some basis of what would be the allowable leakage, the Interstate Commerce Commission condemning tests of air compressors is the basis of the available compressor capacity. This, by the way, in the writer's opinion allows too wide a variation in the condemning tests. A New York No. 5 compressor is only required to deliver 59 cu. ft. of air, which is only 65.5 per cent. of its capacity when in good condition, whereas the 8½-in. cross-compound compressor is required to deliver 86 cu. ft. of free air, which is 90.5 per cent. of its good condition performance.

*Supervisor Air Brakes, New York Central Lines, Cleveland, Ohio. From a paper before the Central Railway Club.

DETAILS OF TESTS

It was decided to determine the leakage by means of an orifice through which air would be supplied at a definite pressure which would be sufficient to provide for the maximum amount of allowable leakage. If, with this arrangement it was not possible to maintain the pressure in the brake pipe, then the leakage was too great. If the brake pipe pressure remained the same, or was raised, it would then be known that the leakage was not excessive. The tests were made on a 100-car freight train, conforming to the following specifications:

Size of equipment, 10-in. (combined); length of cars, 42 ft.; brake pipe volume per car, 920 cu. in.; auxiliary reservoir volume, 2,440 cu. in.; leakage uniformly distributed at car 4 and every tenth car up to and including car 94, regulated by cocks in branch pipe near triple valve; test gages on branch pipes of cars 1 and 95 and on auxiliary reservoir of car 1.

The locomotive equipment was as follows:

Brake equipment, No. 6 ET; main reservoir volume, 50,000 cu. in.; main reservoir pressure, duplex control 100 lb. and 130 lb.; compressor, two 9½-in. or one 8½-in. CC.; steam pressure, 195 lb. to 210 lb.; test gages on main reservoir and brake pipe.

The orifice was placed between the yard air system and the train with a by-pass in which was placed an air meter (Toolometer) by means of which the amount of air passing through the orifice was determined.

Two main classes of tests were made which may be referred to as charging tests and pump-up tests. The first charging tests were made with an orifice of 17/64 in. in diameter, which was computed to furnish an amount of air equivalent to 75 per cent. of a New York No. 5-A compressor capacity. With this orifice and a constant pressure of 80 lb., the brake pipe leakage was regulated until the air flowing through the orifice was just able to maintain 70 lb. pressure in the brake pipe of the first car. By means of the Toolometer it was found that this rate was 41 cu. ft. of free air per minute.

This rate was used as a basis for making the pump-up tests, using the locomotive with

two 9½-in. compressors and 200 lb. steam pressure. Fig. 1 shows a graphic record of the results of the pump-up test in which an empty train was charged to a pressure of 70 lb. on car 1. The train was charged with the brake valve in running position. When the first car of the train was charged to 70 lb., an attempt was made to raise the pressure to 85 lb. by placing the brake valve handle in full release position. After more than 20 minutes the pressure became stationary at 82½ lb. By means of the orifice, the yard plant apparatus and the Toolometer, it was found that 50.4 cu. ft. of free air per minute was required to maintain the total train leakage under these conditions.

It was then concluded that the total leakage rate of 41 cu. ft. of free air per minute at 70 lb. pressure on the first car was too great. The orifice was therefore replaced with one of ¼-in. diameter. This showed that 70 lb. could be maintained on the first car with an 80-lb. yard pressure, with a total leakage rate of 35 cu. ft. of free air per minute. The pump-up test was then repeated and the brake pipe pressure on the first car was raised from 70 lb. to 85 lb. in about 15 minutes, thus showing that the ¼-in. orifice was suitable.

Other tests were made to show how time could be saved in charging the train by placing the brake valve in the release position until the train had been nearly fully charged, then moving it to a running position, thus bringing the feed valve into operation so that it would not be overcharged. Tests were also made to determine the best way of handling the yard charging orifice. The Toolometer readings were checked and found to be sufficiently accurate.

The ordinary method of measuring brake pipe leakage on trains is not an accurate check on the total amount of train leakage which the compressor on the locomotive must be able to supply if the train is to be handled successfully.

The method suggested for measuring the total leakage by charging the train through an orifice supplied with a fixed pressure does not afford an accurate means of measuring the total train leakage.

If the maximum permissible amount of train leakage is fixed upon, an orifice size can be determined which when supplied with a constant pressure of 80 lb. from a yard plant

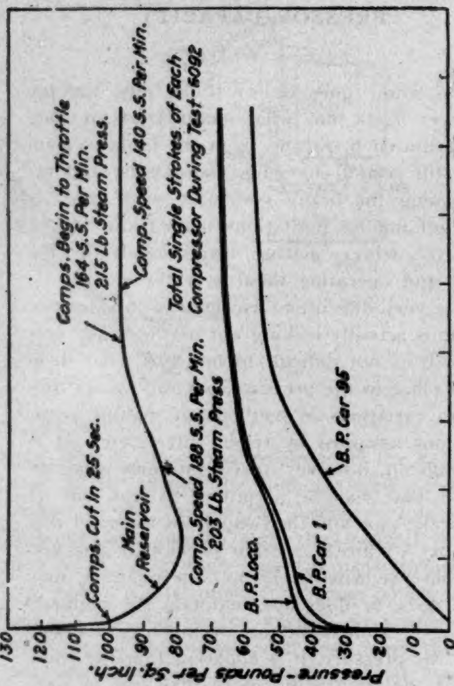


FIG. 1

will just supply the necessary amount of air to the train to maintain the leakage specified.

Such a charging orifice can conveniently be used while charging a train from the yard plant and it will afford a means for accurately determining whether the total leakage of the train is less than, equal to or greater than the maximum permissible leakage.

The best method of manipulating the charging orifice test apparatus is for the operator to start the test with the by-pass around the orifice open and then as the train charges gradually close this by-pass so as to maintain 70 lb. brake pipe pressure on the first car of the train. This method will accomplish the charging of the train in a minimum of time and avoid any objectionable overcharging.

The foregoing seems to point out the necessity of a better brake maintenance and a better initial installation of the brake apparatus; this has particular reference to securing the reservoirs and cylinders to the car body and proper clamping of the brake pipe. A large majority of the leaks are due to loose reservoirs, cylinders, and brake pipes. Tightening of the unions when these parts are loose only affords

temporary relief. More attention should be paid to hose couplings when mounting hose, as many are found that do not gage and when coupled, leak.

A recent investigation of 12 trains, varying from 80 to 114 car per train, showed a loss of air from 30 per cent. to 93 per cent. of the compressor capacity. Losses of this kind are not only expensive in compressor maintenance and coal consumption, but cause serious delays to traffic.

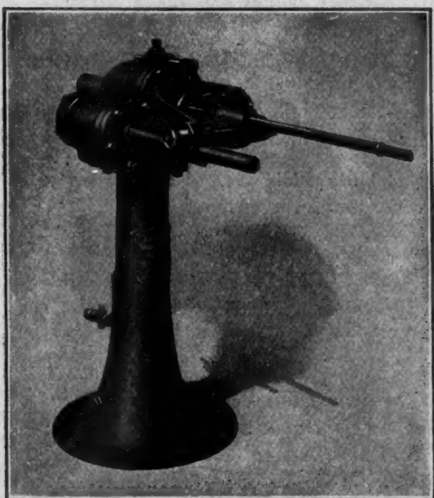


FIG. 1

A NEW LEYNER MACHINE FOR PUNCHING OUT THE BITS AND SHANKS OF HOLLOW DRILL STEEL

The modern hammer drill, using hollow drill steel and air or water to expel the cuttings from the drill hole is today the rule rather than the exception in practically all rock drilling operations. There is more or less carelessness in the matter of keeping the hole in the drill steel properly opened. Plugged steels, wholly or in part, prevent the proper functioning of the drill. Drilling speed is retarded, water tubes are bent or broken and time is lost in tinkering, or, as often happens, the drilling gang is idle while someone makes a trip to the shop for another drill steel or water tube.

To relieve this condition, the Ingersoll-Rand Company has developed and is placing on the market, as an auxiliary to the Leyner Sharpener, a new device, here shown, the Leyner Shank and Bit Punch.

This compact and simple machine consists principally of a cast iron pedestal on the top of which are bolted the clamping and punching cylinders and apparatus. The drill steel is clamped by two jaws brought together by the movement of a pinion, operated by the clamping cylinder through the medium of a rack on the extended piston rod. The heat treated steel punching pin is attached to the

FIG. 2

piston of a punch-operating cylinder, and in such manner that it may be readily removed should occasion require. The front head of the punch cylinder is provided with a clearance space around the punching pin so that on the extreme reverse stroke air is exhausted against the heated pin, effectually cooling it. The maximum stroke of the punch is 6 inches. An adjustable stop for the drill steel is provided to regulate the distance to which it is desired to have the pin penetrate. The standard punching pin is $^5/_{16}$ in. diameter for a distance of 2 in. from the end and $\frac{3}{8}$ in. for the remainder.

The operation of the machine is controlled

by a single lever moving in a T slot. A downward movement clamps the steel and a further slide movement operates the punch. The operation of the control lever locks the clamp jaws before the punch can be brought into action. In like manner the punching device must be in neutral position before the clamp jaws can be opened. This safety feature prevents action of the punch before the steel is firmly clamped and in perfect alignment. It will be noted that all moving parts are protected from dirt, grit and damage by tight fitting covers and likewise the operator is guarded from injury. The machine occupies a floor space 22x44 inches and weighs 400 lbs. A Planking support is the only foundation needed.

HIGH EXPLOSIVES IN METAL MINING

That the metal mining industry is the largest user of high explosives is indicated by the following table of two groups of mining States:

	Alaska, Idaho, Oregon, and Washington, lb., 1916	Arizona, California, and Nevada, lb., 1916
Mining other than coal	8,563,685	25,527,705
Coal mining	464,210	2,000
Railway and construction	3,573,626	3,386,302
All other purposes	7,418,382	5,407,046
Michigan		29,691,122
California		13,942,000

The relative magnitude of the metal mining industry in different States may be inferred from the following arrangement for the year 1916, the figures coming from publications of the Bureau of Mines.

Michigan	24,691,122
Missouri	24,875,757
California	13,942,000
Arizona	13,002,555
Minnesota	10,220,182
Montana	9,162,385
Colorado	8,826,030
Nevada	7,378,443
Washington	6,546,844
Alaska	5,761,280
Utah	5,133,090
New Mexico	3,061,951
Oregon	2,578,689
South Dakota	2,272,840

A DRILL RUNNER'S TROUBLES

The ground is hard as the devil,
The steel wont cut it at all;
The smith knows nix about temper,
The boss ought to give him a call.

One piece is hard and so brittle,
The next one's as soft as lead,
If he don't give us stuff we can work with
I'll crack a length over his head.

My pardner blocks up like a farmer,
The bar's coming down by the feel,
The air and the water hose leaking
Make me most as wet as a seal.

The machine takes oil like a furnace,
And blows it all over the face;
Some sucker has lugged my wrench off
And left an old bum in its place.

The round wont come to the tally,
It's a cinch that the shifter is sore,
If the mucks had got the dirt out
We'd have finished it long before.

The powder and caps are rotten,
The fuse is a genuine fake,
The air is chuck full of water,
And the blasted ground wont break.

There's no use swearing your life out,
This job is awfully tough,
But I think it's time to stop her,
I guess she is in deep enough.

B. A. PRICE, in the *Mascot Concentrate.*

This summer 13,000 tons of coal, or 350 carloads, were floated down the Ohio River to Cincinnati by means of an artificial flood. Dams on the various tributary rivers were opened until an artificial crest of from three to six feet was formed, which was sufficient to float the fleet of barges.

A TRUE OLD FRIEND

Enclosed find Three Dollars ($3) for which please send me Compressed Air Magazine for three years. I have taken the Magazine for, I think, fourteen years.

Yours truly,
George R. Davis.
Parkers Landing, Pa.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

W. L. SAUNDERS, - - - - Editor
FRANK RICHARDS, - Managing Editor
CHAS. A. HIRSCHBERG, - Business Manager
W. C. LAROS, - - Circulation Manager

PUBLISHED MONTHLY BY THE

Compressed Air Magazine Company
Easton, Pa.

New York Office—11 Broadway.
London Office—165 Queen Victoria Street.

Subscription, including postage, United States and Mexico, $1.00 a year. Canada and abroad, $1.50 a year. Single copies, 10 cents.
Those who fail to receive papers promptly will please notify us at once.
Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

Entered as second-class matter at the Easton, Pa., Post Office.

Vol. XXII. NOVEMBER, 1917. No. 11

CONTENTS

WHY WE ARE AT WAR

Germany has forced America, as it has forced practically the entire world, to defend itself by arms. We are fighting this war because Germany made war upon us. America is a peaceful Nation; we have no lust for conquest, no desire for annexation of territory; we are defending ourselves against Germany because the Imperial German Government entered upon a program which meant the destruction of all American institutions.

When we finally recognized that Germany was waging war upon us we had seen more than 225 Americans, among them many women and children, killed by German submarines; hospital ships had been sunk and unfortified towns had been bombed and bombarded. Medals had been struck in honor of the sinking of the *Lusitania*, the murderous act by which so many of our men, women, and children, lost their lives. German officials had treated the United States, a neutral nation, as an enemy. Strikes were organized in this country, plants were blown up, pro-German publications were founded and subsidized, and hatred of America was systematically sought to be inculcated among our foreign-born inhabitants. Every effort was made to involve us in trouble with Japan and Mexico. Our repeated protests were met with promises and explanations which were little better than insults.

The Imperial German Government finally proclaimed the unrestricted destruction of neutral ships upon the high seas. It was the notification to the United States that our people were no longer sovereign, and that if they would sail the seas in safety we must conform to conditions laid down by a Government that defied international law, humanity, and elemental morality.

A policy of terrorism has been systematically applied by the Imperial German Government since the outbreak of the European war. Treaties that stood in the way of German militaristic plans have been disregarded, women and children have been treated with indescribable brutality, the noblest works of art have been destroyed, and prisoners have been abused and maltreated and civilian populations massacred and deported.

This is why America has gone into this war in defense of American honor and American rights. To have done anything else would

have been to surrender our sovereignty, and we would have been forced in the end to fight a conscienceless and rapacious military autocracy—an autocracy which is in this war avowedly for indemnities, aggrandizement, and the control of the world. Our success means that our children and our children's children will be able to enjoy peace.

Buy a Liberty Bond, get behind your Government, and shorten this war. This is your fight. Our men are giving their lives; you are only asked to lend your money. There should be at least one Liberty Bond in every home. There is no better test of your Americanism.—*Bureau of Publicity, U. S. Treasury Department.*

SAVING COMPRESSED AIR

Compressed air costs money and, like everything of value, it can be used economically or it may be wasted, the latter prevailing much too generally, and making especially pertinent the following timely words from *Railway and Locomotive Engineering.*

While the wise spirit of economy is in our midst we take it upon us to state that in the use of compressed air in railroad repair shops we have observed a tendency to extravagance, a disregard of the quantity of air used for any operation, as if its cost were a negligible quantity. The general impression seems to be that air is cheap. This is true as far as ordinary atmosphere is concerned. As a motive power, the air quiescent or moving in currents costs nothing. But when it comes to forcing the atmosphere into smaller bulk in order to increase its pressure the cost is much greater than is generally imagined.

The equivalent, or even greater, in steam pressure, must be first used in compressing the air. The action of complex machinery under the best conditions involves considerable loss in friction. To this must be added the loss in heat and in steam pressure caused by exhausting at considerable pressure. This is increased as the compression of the air approaches the limit of capacity of the enclosing apparatus. The loss by leakage is also considerable, and much of each of these losses cannot be avoided.

An important loss, however, often occurs in the filling of a larger portion of the air hoist cylinder that does not represent any portion of the lift. It can be readily seen that if the piston is raised a considerable distance before it begins to lift the desired load the space in the cylinder must necessarily be filled with air at a high pressure before any work begins to be accomplished. All lifting should begin, if possible, with the piston at the end of the cylinder.

Many of these hoists are now placed in a horizontal position, and by a clever arrangement of pulley, furnish a multiplying point very suitable for light work. At the same time close attention should be given to the economical use of compressed air. Its cost is much greater than steam. The real advantage in the use of compressed air being that it remains cool, so that attached appliances can be handled with a degree of safety impossible in the use of steam.

NEW BOOK

Compressed Air Practice in Mining. By David Penman, London. Charles Griffin & Co., Ltd., Philadelphia: J. B. Lippincott Co. 228 pages 6 by 8 inches, 113 illustrations, $1.75 net.

The author of this book, who is a Certified Colliery Manager and Lecturer in Mining and Engineering at Fife Mining School, has prepared an original work and not a compilation of builders' catalog material. Though normally designed for the use of students in mining schools and colleges it should appeal to all who are interested in the subject. Dealing mostly with English mining practice it may suggest some comparisons to the cisatlantic reader. The general principles involved in the compression, the transmission and the employment of compressed air are discussed and the entire range of practice is very completely covered.

NEW PUBLICATIONS OF THE BUREAU OF MINES

BULLETINS

Bulletin 120. Extraction of gasoline from natural gas by absorption methods, by G. A. Burrell, P. M. Biddison, and G. G. Oberfell. 1917. 71 pp., 2 pls., 17 figs.

Bulletin 138. Coking of Illinois coals, by F. K. Ovitz. 1917. 71 pp., 11 pls., 1 fig.

TECHNICAL PAPERS

Technical Paper 147. Absorption of methane and other gases by coal, by S. H. Katz. 1917. 22pp., 4 figs.

Technical Paper 149. Answers to questions on the flotation of ores, O. W. Ralston. 1917. 30 pp.

Technical Paper 150. Limits of complete inflammability of mixtures of mine gases and of industrial gases with air, by G. A. Burrell, and A. W. Gauger. 1917. 13 pp., 2 figs.

Technical Paper 156. Carbon monoxide poisoning in the steel industry, by J. A. Watkins. 1917. 18 pp., 1 fig.

Technical Paper 169. Permissible explosives tested prior to March 1, 1917, by S. P. Howell. 1917. 19 pp., 1 fig.

NOTE.—Only a limited supply of these publications is available for free distribution and applicants are asked to cooperate in insuring an equitable distribution by selecting publications that are of especial interest. Requests for all papers can not be granted. Publications should be ordered by number and title. Applications should be addressed to the Director of the Bureau of Mines, Washington, D. C.

RAPID DRIFTING

Drifting in solid rock is very different from, and in fact the very antithesis of, drifting at sea, although the movement in the latter case is likely to be much the more rapid of the two. The following is the story of rapid drifting of the former type as told in *Engineering and Mining Journal* by Mr. Axel Peterson, General Foreman, Arkansas and Arizona Copper Company, Jerome, Arizona.

During June, 1917, the 1601 drift on the 16th level of the Arkansas & Arizona mine at Jerome, Ariz., was advanced 535 ft. The formation was diorite for 300 ft. and medium-soft Yavapai schist for the remainder of the distance. All the ground was hard enough to stand without timbering. The diorite drilled much more slowly than the schist, but was blocky and broke better.

The drift was carried 5x8 ft., and an average of sixteen 8-ft. holes was drilled each round. The drilling was done with two No. 148 Super-Leyner drills, using 1¼-in. steel, and mounted on a crossbar. Air was delivered to the drills at a pressure of 110 lb. The drills gave perfect service, and not a minute's time was lost on their account; the only parts replaced during the month were the water tubes. Three shifts per day were worked, and each shift drilled and shot a round. The crew on each shift consisted of three machinemen, three muckers and two trammers, and besides there was a foreman and two track and pipe men on the day shift, making a total of 27 men. An average of 30 cars (19 cu.ft. each) was mucked each shift; the smallest number ever handled on any one shift was 24 and the most 42. The distance trammed was 1500 ft. at the start, and of course increased with the advance to the maximum of 2035 feet.

The order of work was for the machinemen to muck back a space about 6 ft. long at the face, and down within 1 ft. of the bottom; then they set up the drills and put in 13 holes. By the time that was done the muckers had the muck all out, and the drills were then torn down and reset in the bottom and three mucker holes drilled. A 40 per cent gelatin powder was used, and the average charge took 75 lbs. Ventilation was secured with a No. 5½ Root blower running as an exhauster and sucking through 3500 ft. of 15-in. and 12-in. pipe. Five minutes were usually sufficient to clear the fumes from the face so that all holes could be reloaded and shot which had not broken at the first shooting; and 15 minutes always cleared the drift completely so that the succeeding shift could begin work.

ADVANTAGES OF BLAUGAS

Under the Pintsch system, oil is distilled in retorts at a temperature of 900° to 1,000° C., (1652 to 1832 F.) producing as large a quantity of fixed gas as possible. Herman Blau has modified this system, however, by maintaining the temperature of the retorts at about 500° or 600° C., (932 or 1112 F.) thus preventing the production of a large percentage of fixed gases. The gas thus obtained is washed, scrubbed and purified as usual and stored in a holder. From the holder it is drawn into a three or four-stage compressor. Those hydro-carbons that would condense under normal conditions, and hence are not desired in the final product, are removed during the first and second stages of compression while the remainder of the gas is compressed in the remaining stages of 100 atmospheres.

The tar obtained from the gas is used under the retorts, and the permanent gases which the liquefied hydrocarbons have been unable to absorb are stored in large cylinders for use in the engines supplying power to the plant.

The final product, consisting of liquefied hy-

drocarbons and hydrocarbon gases absorbed by them, remains liquid as long as it is kept under compression, but changes at once to a gas upon relief of pressure. At 100 atmospheres the gas is reduced to 1/400 of its volume; its specific gravity is about that of air; and it has a calorific value of 1,800 B. t. u. per cubic foot.

The explosive limits as compared with other gases are as follows, the figures being percentages of gas in the mixture:

	Per Cent.		Per Cent.
Coal gas from	6.33	to	19.33
Acetylene from	2.00	to	49.00
Hydrogen from	9.50	to	66.30
Blaugas from	4.00	to	8.00

Other figures read as follows:

	Hydrogen	Acetylene	Blaugas
Cal. value, B. t. u.	425	1,500	1,800
Contents of 1 cu. ft. retainer, cu. ft.	120	100	200
Weight of retainer to transport, say, 540,000 B. t. u., lb.	1,060	432	100
Price per 100,000 B. t. u.	1.41	1.00	0.40

Blaugas is transported in steel cylinders of various sizes, the most common being one cubic foot. This cylinder when properly filled contains about 20 pounds of Blaugas which will be converted into 250 feet of expanded gas. Blaugas contains no carbon monoxide and is, therefore, non-poisonous. It is used extensively for welding and cutting, brazing soldering and laboratory purposes, and also in districts where city gas is not available.—*Gas Record.*

INCREASED EXPORTS OF U. S. MANUFACTURES DUE TO THE WAR

Seventy-eight per cent. of the more than six billion dollars' worth of American goods exported in the fiscal year 1917 consisted of wholly or partly manufactured goods. In 1914 the last normal year before the war, the percentage of such goods exported was only 59, according to a statement issued by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce.

In 1914 exports of manufactures ready for consumption were valued at $724,908,000, or 31 per cent. of the total exports, while in 1917 their value reached $2,943,923,212, or 47 per cent of the total. Manufactures for further use in manufacturing were exported in 1914 to the value of $374,224,210, or 16 per cent of the total, whereas $1,191,787,957 worth, or 19 per cent of the total, was exported in 1917. The exports of food-stuffs partly or wholly manufactured amounted to $293,218,336 in 1914, or 12½ per cent of the total, and in 1917 to $739,037,884, or 12 per cent of the total.

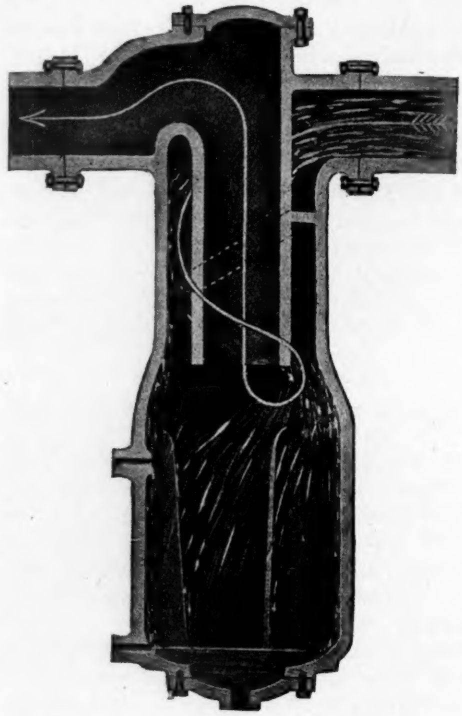


FIG. 1

THE STRATTON AIR SEPARATOR

Readers of Compressed Air Magazine must by this time be tolerably well informed that to have dry compressed air which can be used without more or less inconvenience it is necessary to take the water out of the air after it is fully compressed. The passage of the air through an aftercooler or the conveyance of the air through suitable pipes for a sufficient distance brings the air into a suitable condition for giving up most of the water it contains, but up to this point the water is still in the air, having merely been condensed but not eliminated.

The condition of the compressed air with the minute globules of water in suspension is

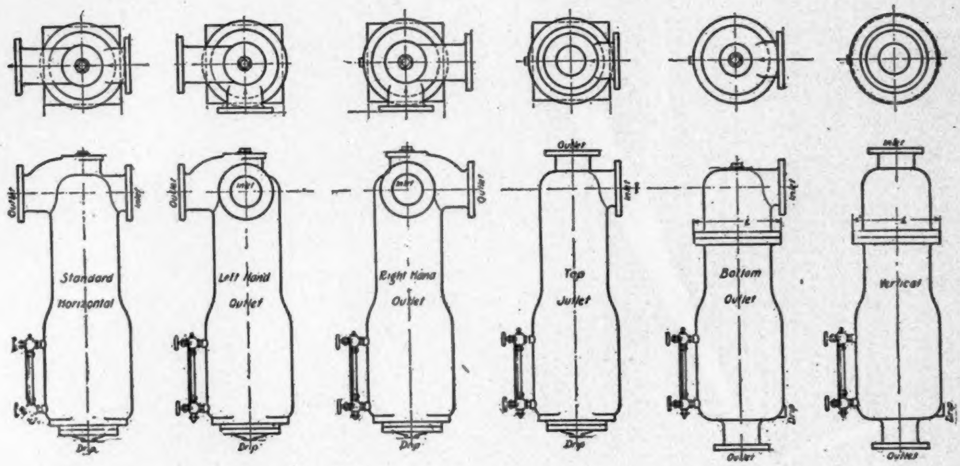


FIG. 2

strikingly similar to that of "wet" steam and it might be safely assumed that a separator which had proved itself efficient in the "drying" of steam would be equally so in the drying of air, and this is the record of the Stratton separator here shown.

As will be seen from the sectional view, Fig. 1, the separator utilizes the action of centrifugal force as the means of separating the water from the air. As the air with its content of condensed vapor enters the separator it is caused to travers a helical path leading around a central core, and the sudden change from the straight line flow imparts a whirling motion to the mass. As the water is several hundred times heavier than the air it does not follow the turn so easily but is thrown with force against the outer wall and adheres there to slowly trickle down and accumulate in the receptacle at the bottom, while the air makes the turn easily and passes on its way without the water.

The Stratton separator, made by the Griscom-Russell Company, 90 West Street, New York City, is coming into general use in compressed air lines, its operation having proved highly successful. It is made in all sizes according to requirements and Fig. 2 suggests the various arrangements of inlet and discharge to suit different piping conditions.

Extension of a branch of the Siberian Railway for 500 miles has opened one of the world's greatest coal fields.

AERATING THE SOIL

There is no question about the necessity for air in the soil, not only to supply the beneficial bacteria and plant roots but also to play its part in the complex chemical reactions which take place in the soil. It is particularly necessary for the nitrogen-gathering bacteria since their only source of the valuable nitrogen, which is to be supplied by them to legumes (such as cowpeas, velvet beans, alfalfa and soy beans) and to the soil itself (by the azotobacter organism), comes from the soil air which under normal conditions circulates in the upper six or eight inches of the soil.

The first step of course is drainage. But drainage alone will not sufficiently alter the texture of compact soils. The next steps are to gradually deepen the tillage of the soil and at the same time to add great quantities of organic matter. In plowing deeper than ever before care should be taken not to plow too deeply at one time. This is best done in the fall or winter in preparation for corn, plowing about two inches deeper than heretofore. This land should be left-rough-plowed for a month or two to expose the new inert soil to the action of the weather. At the same time a heavy growth of peas or velvet beans may be turned under. Where new soil has beeen turned up in this way and after it has beeen worked down, a very light dressing (say about 3 tons) of stable manure will inoculate it with beneficial soil bacteria and increase its productivity materially. Land handled in this way may be

gradually deepened to the limit of economical tillage.

The use of power machinery will increase this depth and at the same time increase the producing power of the soil and make it more drought-resistant. Practically any kind of crop stubble or residues are valuable as organic matter for this purpose and manure mixed with a quantity of straw or similar material (even sawdust in moderate quantities) is highly desirable. Besides these factors, plenty of the right kind of cultivation at the right time is essential. Cultivation keeps the soil open so that the air can circulate freely in its upper layers.—*Louisiana Planter.*

NOTES

That from 5,000,000 to 6,000,000 cu. ft. of natural gas is going to waste daily in Kansas City because of leaky mains of the Kansas City Gas Company was the charge made recently by John N. Landon, receiver for the Kansas Natural Gas Company.

Canton's noted walls, which have stood for centuries, are now being torn down in the interests of progress, and trolley lines are to be built that will completely encircle the city and give the visitor an inexpensive and pleasant means of "seeing Canton."

The people of Apolda, a big town in southwestern Germany, have as a punishment for their extravagance in the use of fuel recently had their gas supply cut off for twenty-four hours. People whose gas bills do not show a seemly fall are threatened with having their gas meters removed altogether.

Rotting of wood, as is generally known, is caused by vegetable growths which feed upon its substance and so alter its characteristics that we say that the wood has become rotted. Ordinarily these vegetable growths are fungi, but there can be little doubt that the roots of grass and trees also attack wood in a similar manner.

Production of gasoline from natural gas increased to 38,848,144 gal. in 1916, a gain of 59 per cent. over that of 1915, and the price averaged 14 cents a gallon in 1916 as against 6 cents in 1915, making a gain of 180 per cent. in value of the gasoline produced.

One gallon of gasoline can under possible conditions render 2100 cu. ft. of air explosive.

Chicago in 1916 used an average of 620,000,000 gallons of water daily, or 249 gallons —8 barrels—per capita.

Sir Eric Geddes, recently appointed First Lord of the Admiralty, (British) began his industrial career at the age of 17 on the Baltimore & Ohio Railroad, where he remained for three years.

The Bureau of Mines, Department of the Interior, at the request of the Council of National Defense, has completed a census of mining engineers, metallurgists and chemists, with the result that 7,500 men engaged in mining and 15,000 men engaged in various chemical industries have been classified according to the character of work in which each one claims proficiency.

A gas well, which proved to be not a gas well, and very nearly the deepest boring in the world, has just been abandoned at Candor, Pa. It is 7,245 ft. deep, was drilled by the Peoples Natural Gas Company, and cost the owners more than $500,000.

When applying cement plaster or stucco to a base which is in the least porous, such as tile, brick, old concrete walls, floors, etc., the base must be thoroughly soaked with water before applying, otherwise the water will be drawn out of the fresh concrete before it has had a chance to set properly and the result will be a failure.

Manager A. G. Keating of the Big Jim Consolidated at Oatman, Arizona, being unable to secure a suitable engine within a reasonable time, has installed a six-cylinder, sixty-horsepower automobile engine, connected it up with the big Imperial type Ingersoll-Rand compressor, and is securing excellent results. Air is furnished for a 300 gallon per minute pump as well as for the power drills.

The New York, New Haven and Hartford Railway Company has taken steps to employ both younger and older men in the Operating Department than have been accepted heretofore. The former age limits for hiring men

were 21 to 35 years. Under the new plan the limits for firemen will be 18 to 45 years, for trainmen, 18 to 50 years; and for other employees, 18 to 60 years.

The United States is the largest producer and consumer of talc in the world, according to the U. S. Geological Survey. The softness, absorptive capacity, difficult fusibility and solubility, and electric resistance of talc make it one of the useful minerals in the arts and industries. Its principal military use is to prevent sore feet among marching soldiers. Although the War has stimulated production it has not greatly increased the price.

A Bill has been introduced into the Second Chamber of the Netherlands Parliament for the draining of the Zuider Zee. It is estimated that the carrying out of the project will require fifteen years and cost over $45,000,000, of which two-thirds would be for the dam and auxiliary works and one-third for the draining. In addition, there would be works and measures of a protective nature, the cost of which, as estimated, would swell the grand total to about $90,000,000.

The Bureau of Mines has prepared specifications for Federal purchases of gasoline in the District of Columbia, according to which the color, which must be water white, is tested by inspection of a column in a four-ounce sample bottle. There must also be a total absence of acidity, which is tested by thoroughly shaking 10 cubic centimeters of gasoline with 5 cubic centimeters of distilled water. The mixture must not color blue litmus paper pink.

In a technical paper of the U. S. Bureau of Mines, Dr. J. A. Watkins states that one of the earliest symptoms complained of by those daily exposed to small quantities of carbon monoxide is persistent and distressing headache, accompanied at times, when the headache is severe, by nausea and vomiting. A peculiar feature of this symptom is that headache often does not begin until some time after exposure, that is, after the employee has left work, but in most instances it affects the individual the whole time he is at work, becoming more severe as the day wears on. Attacks of giddiness are common.

A. H. Crane, sentenced to the Nevada State Prison for burglary, found chemistry an absorbing study. All his leisure time was spent at it until he became expert. Last June he announced he had discovered a new and cheaper process for extracting oil from shale. Crane was granted a pardon at a special session of the parole board in order that he may perfect his process and superintend the erection of an extraction plant. His method of extracting oil from shale will be of great value to the government.

Investigations have demonstrated that to stop the average heavy freight train from a speed of 15 miles an hour, and to again bring it up to the same speed, means the expenditure of from 300 to 750 lbs. of coal, and this again means that if many avoidable stops are made a material percentage of profits is wasted. As a consequence schedules on well managed roads are now arranged so that there shall be as little interference with the movement of freight trains as possible, even if some passenger trains have to be inconvenienced in the process.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

SEPTEMBER 4

1,238,760. METHOD OF DAMP-PROOFING BURIAL-VAULTS. Andrew W. Graham, Buffalo, N. Y.

The method of rendering burial vaults impervious to moisture which consists in coating the walls of the vault with damp-proofing material, closing the vault hermetically, and thereafter filling the closed vault with fluid under pressure whereby to drive the damp-proofing materials outwardly into said walls.

1,238,952. DIVING-GEAR. Hermann Stelzner, Lubeck, Germany.

1,239,022. PRESSURE - REGULATING VALVE. Lucian B. McClean, Green Bay, Wis.

1,239,260. DEVICE FOR RAISING SUNKEN SHIPS. Charles H. Curtiss, Detroit, Mich.

3. A deflatable bag for raising sunken ships which consists of a water-tight and air-tight cylindrical structure, a saddle extending over said bag and secured thereto, a series of diagonal tension members extending transversely of the saddle from one longitudinal edge to the other, a series of main parallel tension members placed over the diagonal members and extending circumferentially of the air bag from one longitudinal edge of the saddle to the other, and means extending between the opposite ends of each main tension member to transmit the lifting stresses of the bag.

1,239,283. PNEUMATIC APPARATUS FOR APPLYING ROUGH-CAST OR OTHER PLASTER TO THE WALLS OF BUILDINGS OR STRUCTURES OR OTHER SURFACES. John Layng McKim, London, and John Johnston, Westminster, London, England.

1,239,407. MILKING APPARATUS. Peter Larsen, Cattaraugus, N. Y.

1,239,440. AIR AND VACUUM CONTROLLING DEVICE. Harry Hall Hess, Philadelphia, Pa.

SEPTEMBER 11

1,239,515. MACHINE FOR OZONIZING AIR. Andrew Peterson, Newark, N. J.

1,239,519. POWER - GENERATOR. Alcorn Rector, New York, N. Y.

1. In a power generator, the combination of an explosion case; a gas supply pipe, communicating therewith; means for igniting fuel in the explosion case; a suction apparatus communicating with the explosion case; automatic means for stopping supply of fuel to said casing; and automatic means for stopping communication between the explosion case and suction apparatus.

1,239,566. UNLOADER FOR COMPRESSORS. Rudolph Conrader, Erie, Pa.

1,239,567. COMPRESSOR. Rudolp Conrader, Erie, Pa.

1,239,568. RELIEF DEVICE FOR COMPRESSORS. Rudolph Conrader, Erie, Pa.

1,239,585. ENGINEER'S BRAKE - VALVE. Joseph P. Gault, Louisville, Ky.

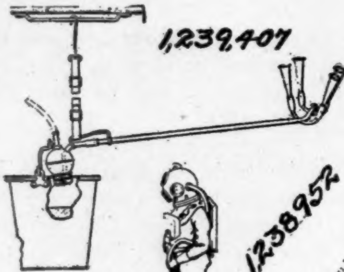
1,239,648. AIR - STARTING SYSTEM FOR INTERNAL-COMBUSTION ENGINES. William Everett Ver Planck, Erie, Pa.

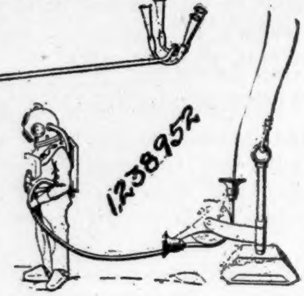
1,239,673. BLAST DEVICE FOR SHOE-POLISHING MACHINES. Gustavo Espinosa de los Monteros, El Paso, Tex.

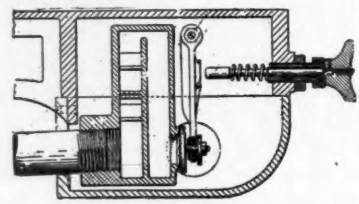
1,239,698. ELECTROPNEUMATIC ORGAN-VALVE. Halsey G. Kinder, Chicago, Ill.

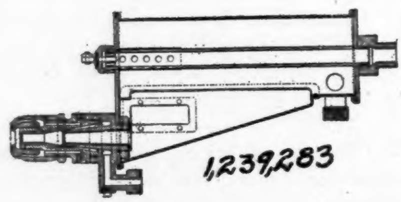
1,239,776. PROCESS OF PRODUCING HEAT. Carleton Ellis, Montclair, N. J.

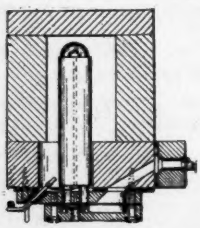
1. The process of producing heat which comprises injecting into a highly heated porous and permeable bed of refractory material currents of gas and air to commingle within the bed and to cause combustion to take

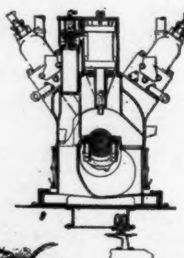

1,239,407

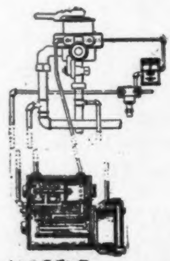

1,238,952

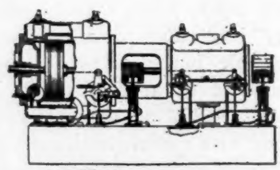
1,239,440



1,239,283

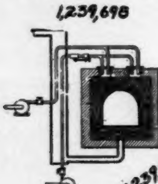

1,239,698


1,239,648

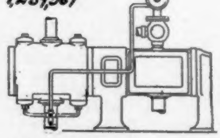

1,239,585

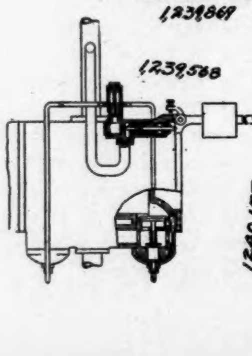

1,239,946

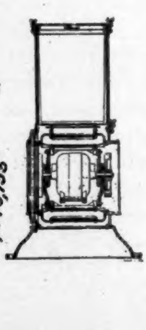

1,239,869

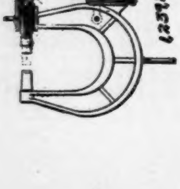

1,239,776


1,239,514

1,239,587


1,239,568



1,240,155


1,239,862

1,239,673


place adjacent the highly heated interior surfaces of the bed at the points of confluence of the gas and air, and positioning the points or places of confluence of the gas and air with respect to the preignitive characteristics of the gas and the respective temperatures of the gas and air.

1,239,815. PNEUMATICALLY - CONTROLLED BLANK-GUMMING MACHINE. Melville E. Peters, George H. Fath, and Albert F. Miller, Denver, Colo.

1,239,862. RIVETING-MACHINE. Archie M. Baird, Topeka, Kans.

1,239,869. GAS-COMPRESSOR. Louis Block, Mamaroneck, N. Y.

1,239,908. AIR - MOISTENER. Robert W. Hardie, White Plains, N. Y.

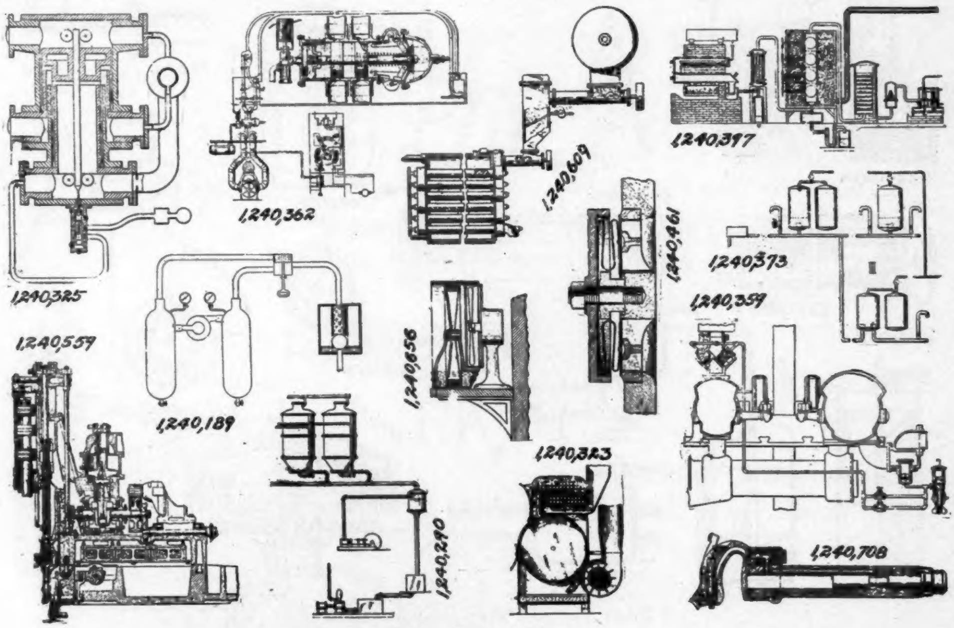
1,239,918. PULVERIZED - COAL - BURNING MEANS FOR LOCOMOTIVES. August Kirchhofer, Nashville, Tenn.

1,239,946. UNLOADING AND CAPACITY-REGULATING MECHANISM FOR COMPRESSORS. Bruno V. Nordberg, Milwaukee, Wis.

either of said first-named reservoirs in communication with said third-named reservoir for the purpose of drawing in such water or expelling it from the chest and consequently increasing or diminishing the weight of the vessel.

1,240,290. PROCESS FOR CLEANING FILTERS IN CONNECTION WITH THE PURIFICATION OF SUGAR, OILS, AND CHEMICALS. Philip L. Wooster, Yonkers, N. Y.

1. The herein described process of cleaning filter beds having a substantial depth and which are exhausted or clogged by a liquid or the solid constituents thereof, which consists in subjecting the lower portion of the filter bed having the substantial depth to the action of a suitable degree of vacuum for withdrawing the clogging material from the lower portion of the filter bed and continuing the action of the vacuum upon such lower portion to gradually withdraw the clogging material from the upper portion of the filter bed through the previously treated lower portion.



Pneumatic Patents September 18

1,240,007. DEVICE FOR PROTECTING SHIPS. Frank William Baumhover, Carroll, Iowa.

1,240,153. PNEUMATIC CUSHION FOR SHOES. George Olsen, Trenton, N. J.

1,240,155. VACUUM - CLEANER. Howard Small, Jenkintown, Pa.

SEPTEMBER 18

1,240,180. MEANS FOR RAISING SUNKEN VESSELS. Rafael de Arazoza, Habana, Cuba.

1,240,189. BALLAST CONTROL FOR SUBMARINES. Guido Fornaca, Turin, Italy.

1. Means for quickly altering the depth of submergence of submarines, comprising two reservoirs for air or gaseous fluid which are so arranged that one of the reservoirs is maintained in a condition of pressure and the other in a condition of vacuum, a third reservoir or chest in turn in communication with the sea water, and means for placing

1,240,323. DRY-CLEANING FUME-EXTRACTOR. Samuel S. Dresher, Omaha, Nebr.

1,240,325. AUTOMATIC CONTROLLING OR REGULATING APPARATUS. George Goodell Earl, New Orleans, La.

1. In a device of the class described, the combination of a plurality of fluid pressure cells provided with openings in the walls for the admission of fluid under pressure, movable means between said cells exposed to the pressures therein, guiding means for said movable means, flexible means connected to said movable means and separating said cells, and a valve and valve stem controlled by said movable means.

1,240,362. VACUUM-PLENUM PNEUMATIC-CARRIER-DESPATCH SYSTEM. Albert W. Pearsall, Lowell, Mass.

1,240,373. PNEUMATIC HYDROSTATIC SYSTEM. Adolph Roszkowski, Petrograd, Russia.

1,240,397. APPARATUS FOR PRODUCING LIQUEFIED GAS. Linus Wolf, Chicago, Ill.

1. In an apparatus for producing liquefied constituents of a gas containing hydrocarbon constituents, the combination with a cooling chamber, of means to cause the gas to pass therethrough, means to compress said gas and liquefy the liquefiable constituents thereof, and means to return a portion of the liquefied gas to the cooling chamber and to allow it to expand therein and become commingled with the gas passing therethrough whereby the gas in the cooling chamber is highly refrigerated by being commingled with the cold gas produced by the expansion of the liquefied gas.

1,240,461. VALVE FOR COMPRESSORS. Charles H. Leinert, Chicago, Ill.

1,240,531. REGULATING MECHANISM FOR CENTRIFUGAL COMPRESSORS. Otto Banner, Easton, Pa.

1,240,539. REGULATOR FOR FLUID-COMPRESSORS. Emery L. Buckley, Painted Post, N. Y.

with a saline solution and oil, charging the mixture with gas, by throttled injection discharging the pulp thus formed into a closed separating chamber or tank, the supply of gas being sufficient to create a body of gas under pressure in the upper portion of said tank and returning the gas from the region of froth formation to the region of pulp and gas injection.

1,240,855. PUMP. Howard B. Jones, Evanston, Ill.

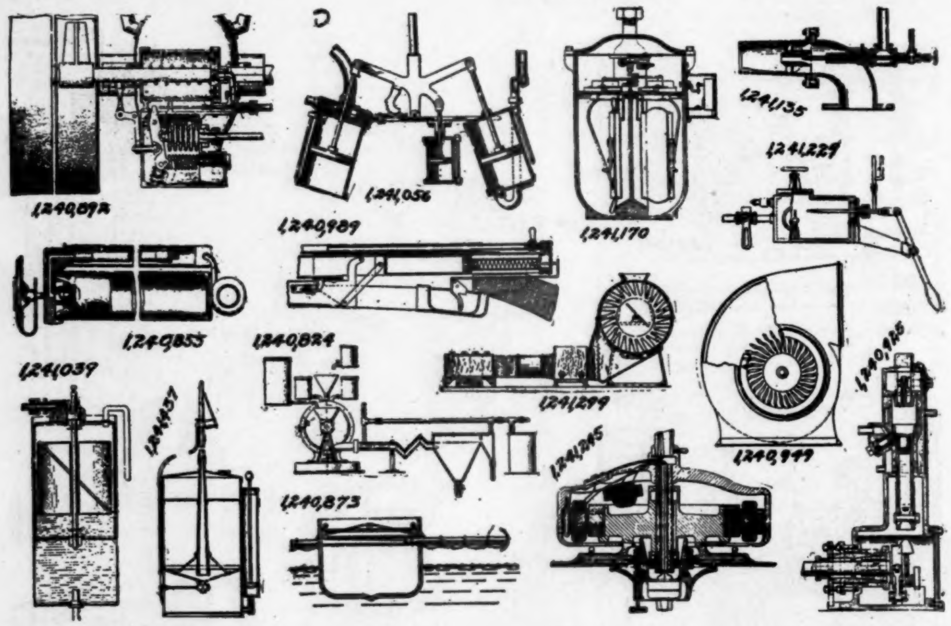
1,240,873. BUOYANCY ATTACHMENT FOR SHIPS. Joseph Persak, Burwell, Nebr.

1,240,892. COMPRESSOR. Stephen G. Skinner, Wilmette, Ill.

1,240,925. GAS-COMPRESSOR. Frank M. Bennett, Berkeley, Cal.

1,240,949. CENTRIFUGAL FAN. Albert A. Criqui, Buffalo, N. Y.

1,240,989. AIR-GUN. Charles F. Lefever, Plymouth, Mich.



PNEUMATIC PATENTS SEPTEMBER 25

1,240,559. ELECTRO-PNEUMATIC CHANNELING-MACHINE. Arthur H. Gibson, Easton, Pa.

1,240,609. COOLING APPARATUS. Stewart E. Seaman, Brooklyn, N. Y.

1,240,656. AIR AND TEMPERATURE MODIFYING MEANS. Frank V. Benson and Robert Sandstrom, Los Angeles, Cal.

1,240,683. OIL-BURNER. Theron C. Curtiss, San Francisco, Cal.

1,240,708-9. PNEUMATIC PERCUSSIVE TOOL. Charles H. Haeseler, Philadelphia, Pa.

1,240,796. AIR-BRAKE-CONTROLLING MECHANISM. Thomas W. Scott, Baltimore, Md.

SEPTEMBER 25

1,240,824. PROCESS OF CONCENTRATION OF METALLIFEROUS ORES. Selden Irwin Clawson, Salt Lake City, Utah.

1. The herein described improvement in concentrating ores by the flotation process which consists in mixing the pulverized ores

1,241,039. VACUUM FUEL-FEEDING SYSTEM FOR GAS-ENGINES. Wilfred Shurtleff, Moline, Ill.

1,241,056. APPARATUS FOR PRODUCING ARTIFICIAL RESPIRATION. William E. Tullar, Chicago, Ill.

1,241,135. BURNER. Henry J. Mastenbrook, Lakewood, Ohio.

1,241,170. FLUID-METER. Frederick C. Viney, Philadelphia, Pa.

1,241,229. METHOD OF SEALING GLASS BULBS. Albert J. Loepsinger, Providence, R. I.

1,241,245. MOTOR-FAN. Linus J. Parker, Fulton, N. Y.

1,241,299. DRYING APPARATUS. Gerardus Hendrikus Stroband and Johanes Henricus Stroband, Amsterdam, Netherlands.

1,241,372. APPARATUS FOR OPERATING THE BLOW-OFF VALVES OF CENTRIFUGAL COMPRESSORS OR PUMPS. Hans Guyer, Zurich, Switzerland.

1,241,437. DEVICE FOR SPRAYING POWDER AND LIQUID. John Dal Pian, Detroit, Mich.